From: Howard, Leslie Ann CIV USN BRAC PMO SAN CA (USA) [leslie.howard@navy.mil]
Sent: Tuesday, September 1, 2020 7:12 AM
To: Peter Loveridge [peter.loveridge@errg.com]
CC: Dennis Kelly [dennis.kelly@errg.com]; Stoick, Paul T CIV USN NAVFAC SW SAN CA (USA) [paul.stoick@navy.mil]
Subject: FW: RB2 Review of Parcel E-2 Draft Final Phase II RACR
Attachments: RTC - DF_RACR_Parcel E-2 (Rev 1).pdf; FINAL_RACR_PE2_REDLINE_(Rev1).pdf; 500506-B24-Fig 6 (Rev1).pdf; 500506-B25 Fig 7 (Rev1).pdf; 500506-B26 Fig 8.pdf; 500506-B16 C2 (Rev 1).pdf; 500506-B17 C3 (Rev 1).pdf; 500506-B19 C6 (Rev 1).pdf; 500506-B20-C7.pdf; Water Quality Data Chart-DO (Rev1).pdf; Water Quality Data Chart-pH (Rev1).pdf; Water Quality Data Chart-Turbidity (Rev1).pdf

Importance: High

Morning Peter

Do you or someone with E-2 knowledge have time to review the revised RTCs for the DF E-2 RACR? I need to submit to the BCT on Tuesday, Sept 8th. So if you see any issues, please let me know so Aptim can make revisions.

Especially focus on DTSC Comment #5 (page 8 of 32) and Water Board Comment #17 (page 30 of 32).

The new comments are in GREEN with our new responses in RED.

Thank you!

Leslie

Leslie A. Howard, CHMM
Remedial Project Manager
Navy BRAC PMO West
33000 Nixie Way
Bldg 50, 2nd Floor
San Diego CA 92147
Desk Phone: 619-524-5903
Main Office Phone: 619-524-5096

From: Johnson, Nels <Nels.Johnson@aptim.com>
Sent: Monday, August 31, 2020 7:57 PM
To: Howard, Leslie Ann CIV USN BRAC PMO SAN CA (USA) <leslie.howard@navy.mil>
Cc: Ayala, Mike <Mike.Ayala@aptim.com>; Hoch, Kevin <Kevin.Hoch@aptim.com>
Subject: [Non-DoD Source] RE: RB2 Review of Parcel E-2 Draft Final Phase II RACR

Leslie,

For your review and distribution, please find the updated Response to Comments (RTC) file to the Draft Final Remedial Action Completion Report, Parcel E-2 Phase II.

This submittal is the result of incorporating miscellaneous comments received through the most recent round of review by DTSC, CDFW, and the SF RWQCB.
The new comments are in **GREEN** with our new responses in **RED**.

**** Note**** If you would please make sure you are good with our response to DTSC Comment #5 (page 8 of 32) and Water Board Comment #17 (page 30 of 32) before we forward anything along as I felt we may have been responding for the Navy. If you need anything change, just let us know and we will be able to clean it up first thing tomorrow morning.

In support of the revised RTCs, you will also find the following:

- **REDLINE Text File** (presenting the proposed text changes in Redline/Strikeout)
- Figures
  - **Figure 6** (Revised)
  - **Figure 7** (Revised)
  - **Figure 8** (Previously issued)
- Appendix C – Construction As-Built Drawings
  - **Drawing C2** (Revised)
  - **Drawing C3** (Revised)
  - **Drawing C6** (Revised)
  - **Drawing C7** (Previously issued)
- Appendix Y – Water Quality Monitoring Results
  - **Water Quality Data Chart-DO** (New)
  - **Water Quality Data Chart-pH** (New)
  - **Water Quality Data Chart-Turbidity** (New)

If you have any questions regarding this submittal, please contact Mike Ayala at (925) 408-7121 or me at (925) 787-0677.

Thanks, Nels

NELS JOHNSON, PE
Sr Project Manager

APTIM | Government Services

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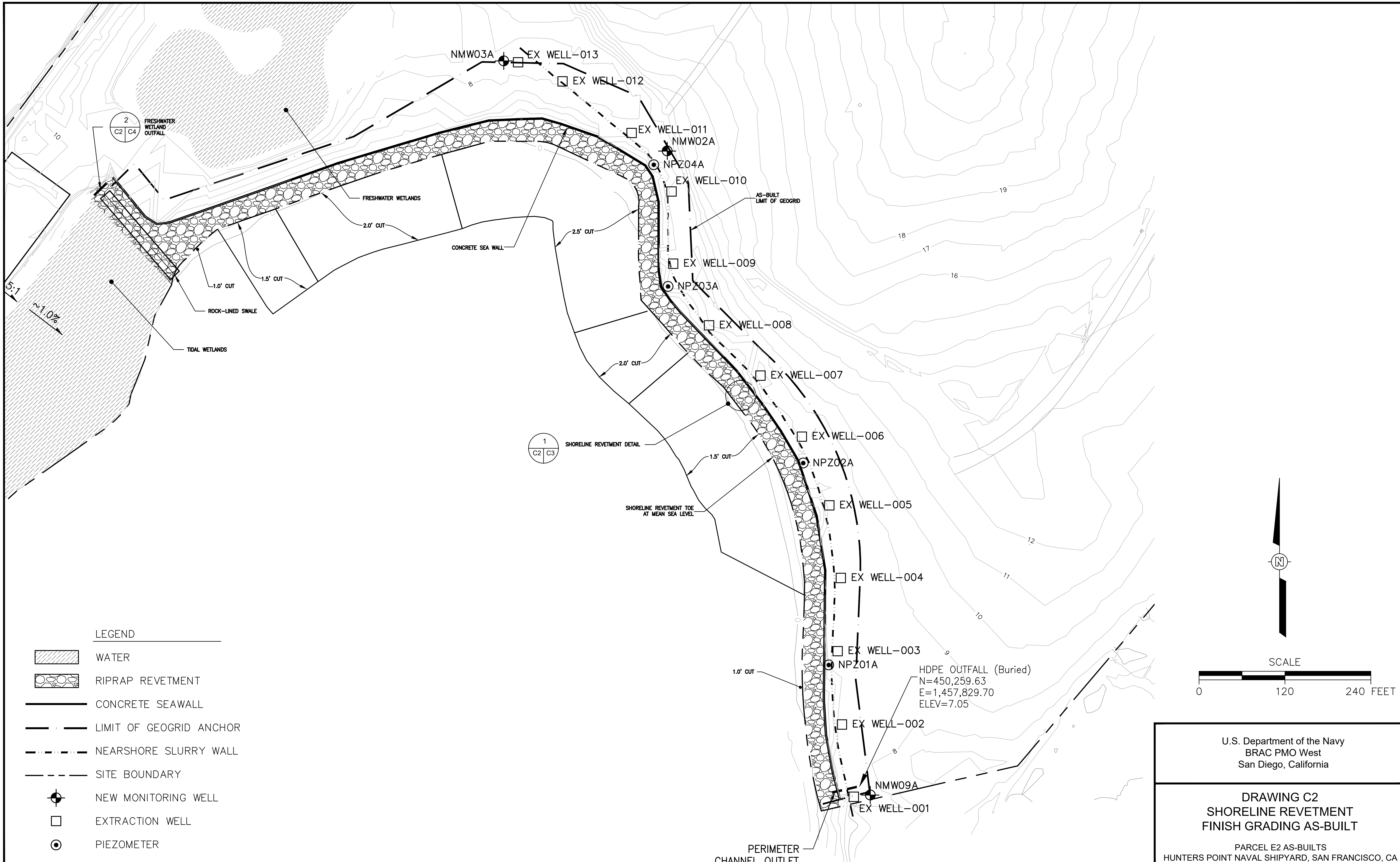
4005 Port Chicago Highway, Suite 200
Concord, CA 94520



500506-B16

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MAST_DSGN
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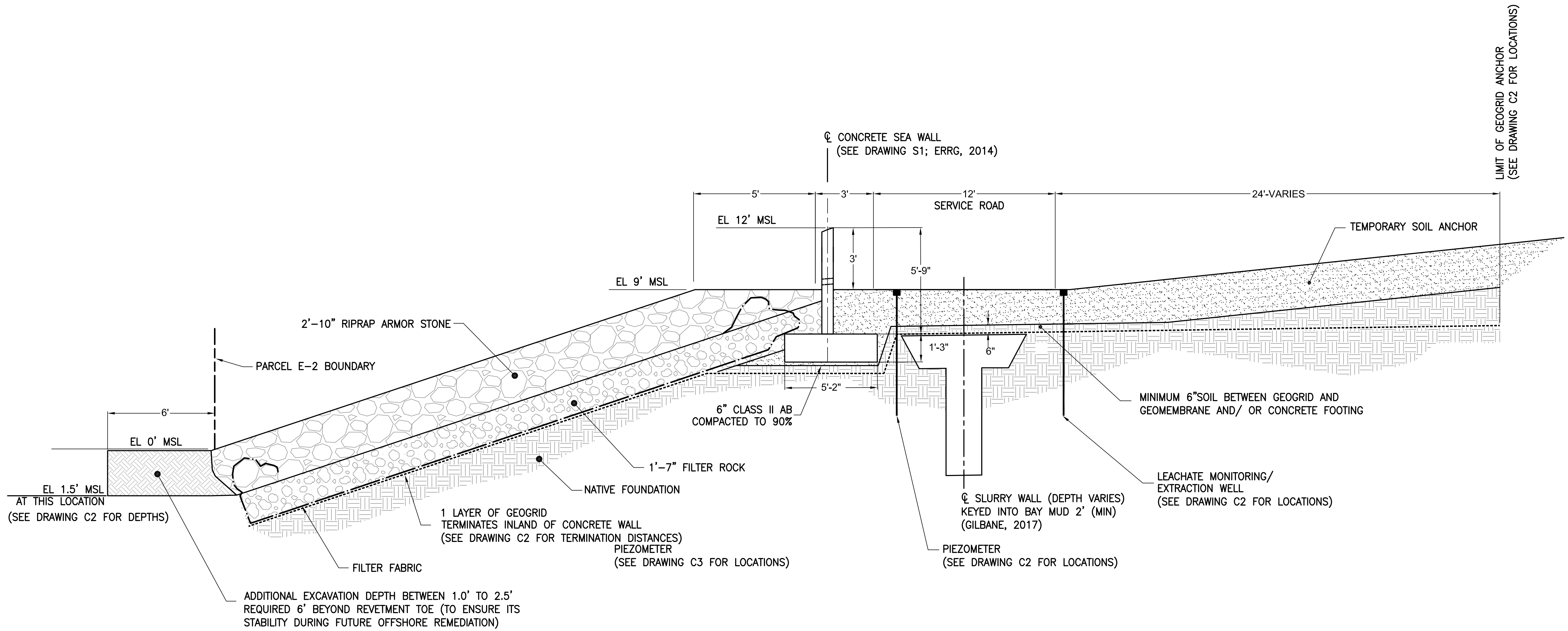

1 C2 C3 SHORELINE REVETMENT DETAIL

SCALE

0 6 12 FEET

NOTE:

THICKNESS OF THE TEMPORARY SOIL ANCHOR PLACED TO MATCH THE ELEVATION OF THE FINAL COVER. THE UPPER TWO FEET OF THIS SOIL LAYER WILL BE REMOVED BY A FUTURE REMEDIAL ACTION CONTRACTOR TO ALLOW FOR INSTALLATION OF THE PROTECTIVE LINER AND VEGETATIVE SOIL COVER.

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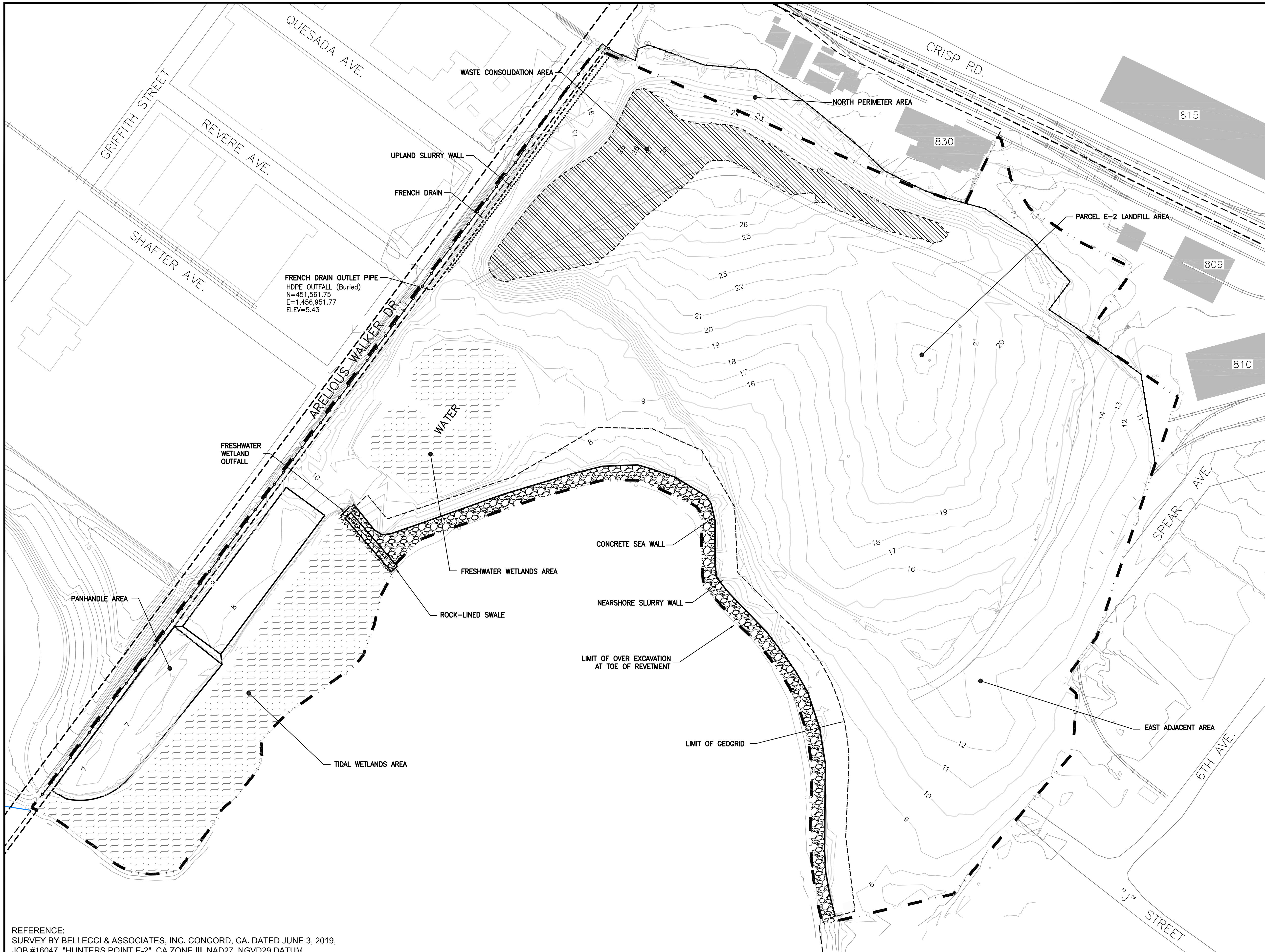
BRAC PMO West
San Diego, California

DRAWING C3

SHORELINE REVETMENT DETAIL

PARCEL E2 AS-BUILTS
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA



LEGEND

- EXISTING UNPAVED ROADS
- 590 FINAL AS-BUILT FOUNDATION CONTOURS
- PARCEL E-2 BOUNDARY
- LIMIT OF GEOGRID ANCHOR
- CONCRETE SEAWALL AS-BUILT
- WATER
- STONE REVETMENT

SCALE
0 200 400 FEET

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BRAC PMO West
San Diego, California

DRAWING C6

FOUNDATION GRADING AS-BUILT

PARCEL E2 AS-BUILTS
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

REFERENCE:
SURVEY BY BELLECCI & ASSOCIATES, INC. CONCORD, CA. DATED JUNE 3, 2019,
JOB #16047, "HUNTERS POINT E-2". CA ZONE III, NAD27, NGVD29 DATUM

500506-B19

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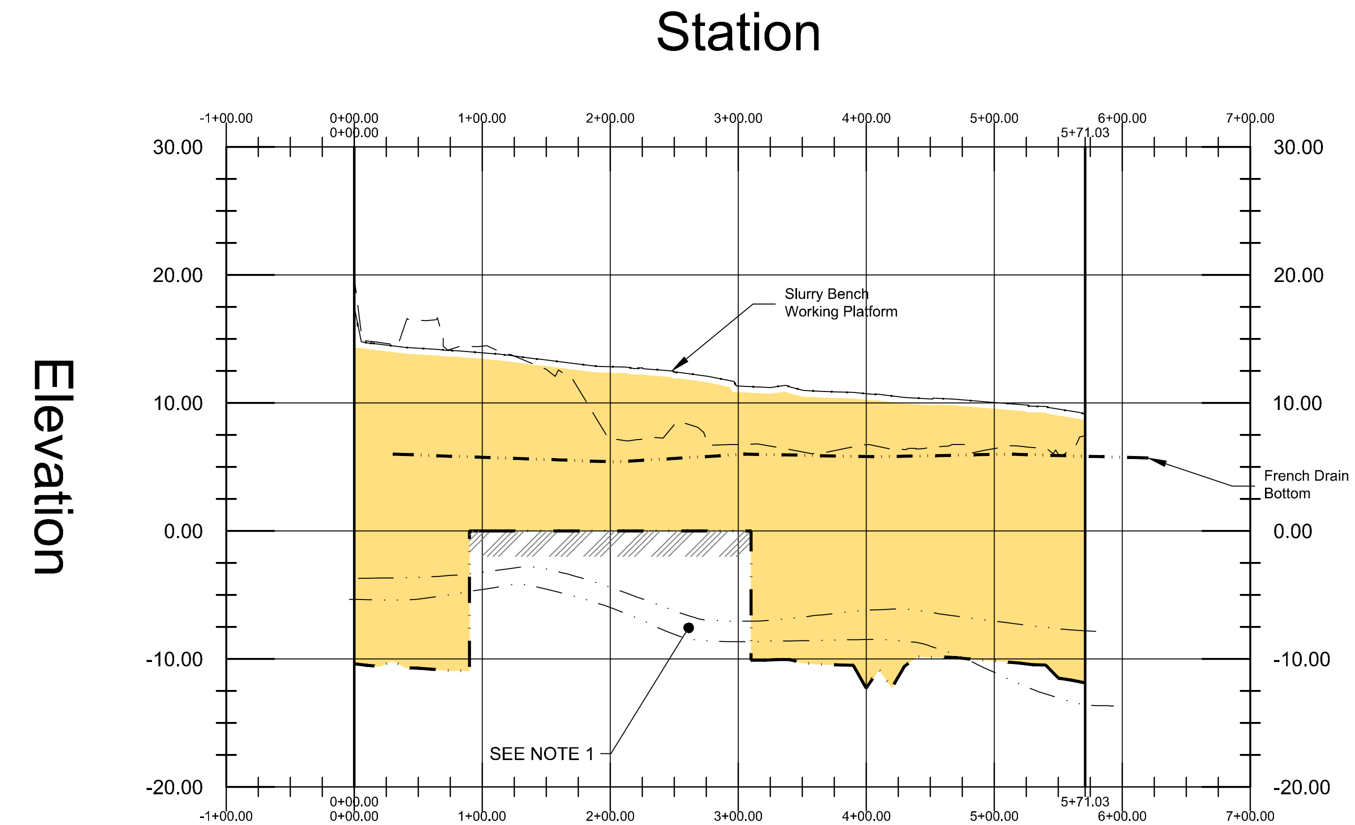

Profile View of Alignment - (Upland Slurry Wall)

SECTION (D / C6 C6)

SCALE: HORIZONTAL 1" = 150'
VERTICAL 1" = 15'

LEGEND

- PRE-EXISTING TOPOGRAPHIC CONTOURS
- SLURRY BENCH WORKING PLATFORM
- APPROXIMATE BOTTOM OF SLURRY WALL
- APPROXIMATE DEPTH TO BAY MUD (ERRG, 2014)
- APPROXIMATE LOCATION OF UNKNOWN OBSTRUCTION
- CEMENT BENTONITE SLURRY WALL (10,247 VSF)

Notes:

1. BAY MUD FOR SECTION IS NONCONTIGUOUS AND NOT CONSIDERED AN AQUITARD.

SCALE IN FEET

0 40 80 160

TOPOGRAPHY BY: CBL PROFESSIONAL SERVICES INC.
PROJECTION: CALIFORNIA STATE PLANE ZONE 3, NAD 27
VERTICAL DATUM IS NGVD29
DATE OF SURVEY: 11-02-17

LEGEND

- EXISTING UNPAVED ROADS
- 590 PRE-EXISTING TOPOGRAPHIC CONTOURS
- PARCEL E-2 BOUNDARY
- FRENCH DRAIN
- UPLAND SLURRY WALL (571 Lft)

GEOPROBE INVESTIGATION

- CLEAR TO DEPTH
- TARGET DEPTH REACHED WITH DIFFICULT DRILLING
- DRILLING MET WITH REFUSAL

ABBREVIATIONS

VSF VERTICAL SQUARE FEET

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San Diego, California

DRAWING C7
UPLAND SLURRY WALL AND FRENCH DRAIN AS-BUILT

PARCEL E2 AS-BUILTS
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

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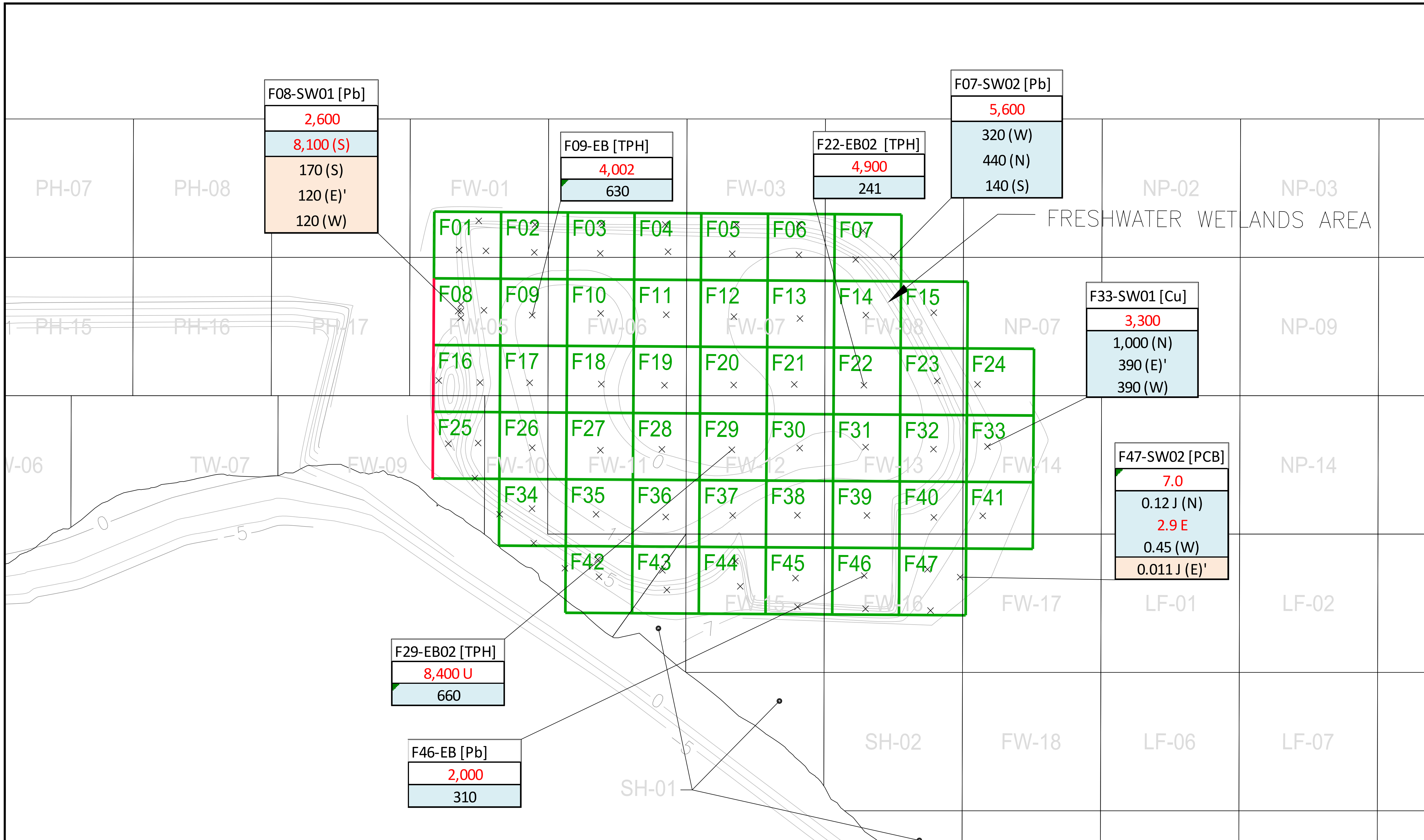

LEGEND

RADIOLOGICAL SURVEY UNIT

50 FT. X 50 FT. SAMPLING GRID

× CONFIRMATION SAMPLE LOCATION - MEETS PROJECT ACTION LIMITS

SEE FIGURE 8 FOR ADDITIONAL INFORMATION

= Over-excavation #1

= Over-excavation #2

= Over-excavation #3

NOTES:
1. ALL CONCENTRATIONS ARE IN mg/kg.
2. RESULTS SHOWN IN RED INDICATE SAMPLES EXCEEDING THE PROJECT ACTION LIMIT.
3. TIER 2 CHEMICAL HOT SPOT GOAL FOR COPPER = 2,700 mg/kg.
4. TIER 2 CHEMICAL HOT SPOT GOAL FOR LEAD = 1,970 mg/kg.
5. TIER 2 CHEMICAL HOT SPOT GOAL FOR TOTAL PCBs = 1.8 mg/kg.
6. TIER 2 CHEMICAL HOT SPOT GOAL FOR TOTAL TPH = 3,500 mg/kg.

SCALE

0 80 160 FEET

ABBREVIATIONS

F	Freshwater Wetlands Confirmation Sample
EB	Excavation Bottom Confirmation Sample
SW	Excavation Sidewall Confirmation Sample
N	North
E	East
S	South
W	West
U	Not detected at the specified reporting limit
J	Estimated concentration
Mg/kg	milligram per kilogram
Pb	Lead
PCB	Polychlorinated Biphenyl
TPH	Total Petroleum Hydrocarbons
Cu	Copper

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 6
FRESHWATER WETLAND FINAL CHEMICAL CONFIRMATION SAMPLE GRIDS

REMEDIAL ACTION COMPLETION REPORT
PARCEL E2
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

500506-B24

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LEGEND

- RADIOLOGICAL SURVEY UNIT
- 50 FT. X 50 FT. SAMPLING GRID
- × CONFIRMATION SAMPLE LOCATION - MEETS PROJECT ACTION LIMITS
- = Over-excavation #1

NOTES:

1. ALL CONCENTRATIONS ARE IN mg/kg.
2. RESULTS SHOWN IN RED INDICATE SAMPLES EXCEEDING THE PROJECT ACTION LIMIT.
3. TIER 2 CHEMICAL HOT SPOT GOAL FOR COPPER = 2,700 mg/kg.
4. TIER 2 CHEMICAL HOT SPOT GOAL FOR LEAD = 1,970 mg/kg.
5. TIER 2 CHEMICAL HOT SPOT GOAL FOR TOTAL PCBs = 1.8 mg/kg.
6. TIER 2 CHEMICAL HOT SPOT GOAL FOR TOTAL TPH = 3,500 mg/kg.

SCALE

0 80 160 FEET

ABBREVIATIONS

T	Tidal Wetlands Confirmation Sample
EB	Excavation Bottom Confirmation Sample
SW	Excavation Sidewall Confirmation Sample
N	North
E	East
S	South
W	West
U	Not detected at the specified reporting limit
J	Estimated concentration
Mg/kg	milligram per kilogram
Pb	Lead
PCB	Polychlorinated Biphenyl
TPH	Total Petroleum Hydrocarbons
Cu	Copper

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 7
TIDAL WETLAND FINAL CHEMICAL CONFIRMATION SAMPLE GRIDS

REMEDIAL ACTION COMPLETION REPORT
PARCEL E2
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

500506-B25

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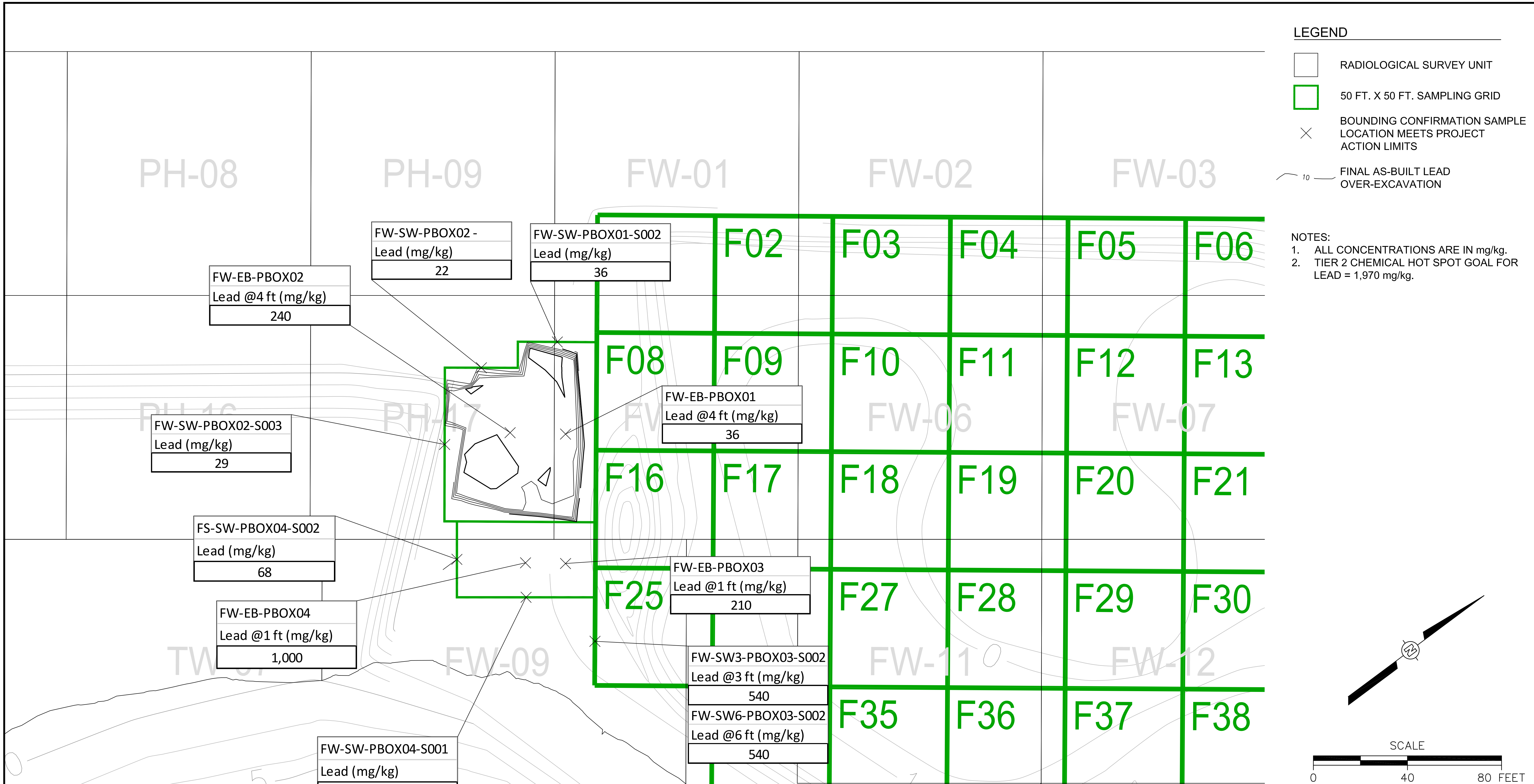

U.S. Department of the Navy
BRAC PMO West
San Diego, California

FIGURE 8
FRESHWATER WETLAND FINAL LEAD EXCAVATION FINAL CHEMICAL CONFIRMATION SAMPLE GRIDS

REMEDIAL ACTION COMPLETION REPORT
PARCEL E2
HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

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Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

~~DRAFT~~FINAL

REMEDIAL ACTION COMPLETION REPORT

Parcel E-2 (Phase II)

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

~~December 2019~~September 2020

Distribution authorized to U.S. Government agencies, Premature Dissemination, 16 December 2019. Other requests for this document shall be referred to NAVFAC SW, BRAC PMO West, 33000 Nixie Way, Building 50, San Diego, California 92147.

DCN: APTM-2005-0013-0047

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

~~DRAFT~~FINAL
REMEDIAL ACTION COMPLETION REPORT

Parcel E-2 (Phase II)

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

~~December 2019~~ September 2020

Prepared for:

Department of the Navy
Naval Facilities Engineering Command Southwest
BRAC PMO West
33000 Nixie Way, Bldg. 50
San Diego, CA 92147

Prepared by:

Aptim Federal Services, LLC
4005 Port Chicago Highway, Suite 200
Concord, CA 94520

Contract Number: N62473-12-D-2005; Task Order: 0013
DCN: APTM-2005-0013-0047

Naval Facilities Engineering Command Southwest
BRAC PMO West
San Diego, CA

~~DRAFT~~FINAL

REMEDIAL ACTION COMPLETION REPORT

Parcel E-2 (Phase II)

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

~~December 2019~~ September 2020

Amy Mangel Primary Author Project Health Physicist	Date
Raymond Schul Technical Reviewer Radiological Operations Manager	Date
Mike Ayala, PE Technical Reviewer Project Engineer	Date
Nels Johnson, PE, PMP Project Manager	Date

Contract Number: N62473-12-D-2005; Task Order: 0013
DCN: APTM-2005-0013-0047

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

List of Figures

List of Tables

List of Appendices

Appendices A through AA (provided on electronic copy only)

Acronyms and Abbreviations

^{226}Ra	radium-226
^{60}Co	cobalt-60
^{137}Cs	cesium-137
^{90}Sr	strontium-90
API	American Petroleum Institute
APTIM	Aptim Federal Services, LLC
bgs	below ground surface
BMP	best management practice
BRAC	Base Realignment and Closure
CB	cement-bentonite
CB&I	CB&I Federal Services LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	chemical of concern
CSO	Caretaker Site Office
cy	cubic yard
DBR	*Final Design Basis Report, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California*
DQO	data quality objective
ERRG	Engineering/Remediation Resources Group, Inc.
FCR	field change request
FW	survey unit freshwater
FWV	field work variance
GSI	Geo-Solutions, Inc.
HDPE	high-density polyethylene
HPNS	Hunters Point Naval Shipyard
HRA	*Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939—2003, Hunters Point Shipyard, San Francisco, California*
IL	investigation level
LLRO	low-level radiological object
LLRW	low-level radiological waste
msl	mean sea level
NaI	sodium iodide
Navy	U.S. Department of the Navy
NRDL	Naval Radiological Defense Laboratory
PCB	polychlorinated biphenyl
pCi/g	picocurie per gram
psi	pound per square inch
QC	quality control
RA	remedial action
RACR	remedial action completion report
RAO	remedial action objective
RASO	Radiological Affairs Support Office

Acronyms and Abbreviations (continued)

RCT	Radiological Control Technician
ROC	radionuclide of concern
ROD	*Final Record of Decision for Parcel E-2, Hunters Point Shipyard, San Francisco, California*
ROI	region of interest
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSI	Radiation Solutions Inc.
RSY	radiological screening yard
RWP	radiological work permit
SCB	soil-cement-bentonite
SU	survey unit
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
VD	virtual detector
Work Plan	*Final Work Plan, Remedial Action, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California*

1.0 OVERVIEW

This remedial action completion report (RACR) presents the specific tasks and procedures implemented by Aptim Federal Services, LLC (APTIM) within Parcel E-2, Hunters Point Naval Shipyard (HPNS), San Francisco, California (Figure 1). The purpose of this RACR is to demonstrate that the remedial action (RA) was successfully completed in accordance with the following, such that the remedial action objectives (RAOs) were achieved~~.~~:

- *Final Record of Decision for Parcel E-2, Hunters Point Shipyard, San Francisco, California* (ROD; Navy, 2012)
- *Final Design Basis Report, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California* (DBR; Engineering/Remediation Resources Group, Inc. [ERRG], 2014)
- *Final Work Plan, Remedial Action, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California* (Work Plan; CB&I Federal Services LLC [CB&I], 2016)

The RA was performed for the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command Southwest, under Contract No. N62473-12-D-2005, Contract Task Order 0013. Base Realignment and Closure (BRAC) Program Management Office West managed the work elements under this contract task order.

There are three implementation phases of the Parcel E-2 RA as described within the DBR (ERRG, 2014) due to high dollar value of the entire remedy. Each phase of the RA addresses individual components of the remedy that are independent of one another. The task order described within this RACR was designated as Phase II. The objective of the Phase II RA was to implement a portion of the remedy selected in the ROD (Navy, 2012), specifically the shoreline revetment; site grading and consolidation of excavated soil, sediment, and debris; and upland slurry wall installation. Remaining components of the DBR will be implemented during the final phase of construction, which will be awarded by the Navy under a separate task order.

Previous removal actions include construction of an additional interim Parcel E-2 landfill cap over 14.5 acres of the landfill that was burned in an August 2000 brush fire. Another earlier removal action addressed the "PCB Hot Spot Area" in the east adjacent area that previously contained soil and construction debris prior to the 1950s. Part of the panhandle contained metal slag disposed of by the Navy ("Metal Slag Area") and a different part of the panhandle area is where the Navy tested ship shielding technologies ("Ship Shielding Area"). Both areas were addressed under earlier removal actions.

1.1 Site Location

HPNS is located on a peninsula in southeastern San Francisco that extends eastward into the San Francisco Bay (Figures 1 and 2). Of the 866 acres that compose HPNS, 420 acres are on land and

446 acres are submerged under water in the San Francisco Bay. Parcel E-2 is located in the most northwestern area of HPNS and contains 47.4 acres of shoreline and lowland coast. Parcel E-2 is bounded by property of the University of California, San Francisco to the north, the San Francisco Bay to the south, Parcel E to the east, and non-Navy owned property to the west. Parcel E-2 sits in an area created between the 1940s and 1960s by filling in the San Francisco margin with materials including soil, crushed bedrock, dredged sediments, and debris (CB&I, 2016). Figure 3 shows pre-existing site conditions.

1.2 Site Description and History

The Navy purchased the land portion of HPNS in 1939 and leased it to Bethlehem Steel Corporation. At the start of World War II in 1941, the Navy took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974 when the Navy deactivated HPNS. HPNS was also the site of the Naval Radiological Defense Laboratory (NRDL) from the late-1940s until 1969. From 1976 to 1986, the Navy leased HPNS to Triple A Machine Shop, Inc., a private ship repair company. In 1986, Triple A Machine Shop, Inc. ceased operations, and the Navy resumed occupancy through 1989. In 1991, HPNS was placed on the Navy's BRAC list, and its mission as a shipyard ended in April 1994. The *Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939—2003, Hunters Point Shipyard, San Francisco, California* (HRA; Naval Sea Systems Command, 2004) gives a history of Navy radiological operations at HPNS (CB&I, 2016). The following radiological operations were identified at Parcel E-2:

- Dials, gauges, and deck markers painted with radioactive paint containing low levels of radium-226 (^{226}Ra) were disposed of at the Parcel E-2 landfill, portions of the panhandle area, and the east adjacent area (CB&I, 2016).
- Small amounts of low-level radionuclides may be present in drain lines in the eastern part of Parcel E-2. Potential release of low-level radionuclides into drain lines at former NRDL buildings located outside of Parcel E-2 in Parcel E may have led to drain lines in the eastern part of Parcel E-2. The drain lines in Parcel E and contamination within are currently being excavated as part of an ongoing RA being performed throughout HPNS (CB&I, 2016).
- Materials used during radiological experiments by NRDL may have been disposed of at the Parcel E-2 landfill and portions of the panhandle and east adjacent area. The HRA suggests that such material was strictly controlled particularly after 1954 when the U.S. Atomic Commission began regulating the use of radionuclides at HPNS. The potential volume of NRDL waste disposed of at the Parcel E-2 landfill is low, as these areas were filled after 1955 (CB&I, 2016).
- Sandblast waste from cleaning ships used during weapons testing in the South Pacific may have been disposed of at Parcel E-2 landfill, the panhandle area, and the east adjacent area. The HRA suggests that the sandblast waste with highest levels or radioactivity was controlled and not disposed of within HPNS (CB&I, 2016).

HPNS was placed on the National Priorities List in 1989 pursuant to Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986, because past shipyard operations left hazardous substances on site. HPNS was designated for closure in 1991 pursuant to the Defense Base Closure and Realignment Act of 1990. Closure involves conducting environmental remediation and making the property available for nondefense use (CB&I, 2016).

The Parcel E-2 landfill is 22 acres in size and contains various shipyard wastes disposed of by the Navy from the mid-1950s to the early 1970s. Waste included construction debris; municipal-type trash; and industrial waste including sandblast waste, radioluminescent devices, paint sludge, solvents, and polychlorinated biphenyl (PCB)-containing waste oils. After closure of the landfill in the early 1970s, it was covered with 2 to 5 feet of soil by the Navy. The estimated volume of waste in the landfill is 473,000 cubic yards (cy) (CB&I, 2016).

Fill materials in the east adjacent, panhandle, and shoreline areas of Parcel E-2 are distinct from the Parcel E-2 landfill area. Figure 2 presents these areas. Fill materials in the east adjacent, panhandle, and shoreline areas primarily consist of soil, sediment, and rock with isolated solid waste locations that are not contiguous with solid waste in the landfill, as described (CB&I, 2016):

- The east adjacent area was created prior to the 1950s by filling in San Francisco Bay with soil and construction debris. Some industrial waste was disposed of in parts of the east adjacent area, including a PCB Hot Spot Area, which was addressed under an earlier RA (CB&I, 2016).
- The panhandle area was created in the 1950s by filling in San Francisco Bay with soil and construction debris. The Navy disposed of metal slag in an area referred to as the “Metal Slag Area.” The Navy also tested ship shielding technologies in another area referred to as the “Ship Shielding Area.” These two areas were addressed under earlier RAs (CB&I, 2016).
- The shoreline area is adjacent to the San Francisco Bay and contains contaminated sediment above mean sea level (msl).

1.3 Topography and Site Features

Prior to implementation of this RA, the ground surface elevation of Parcel E-2 ranged from approximately 30 feet above msl in the northern portion of Parcel E-2, to a few feet above msl along the southwest portion of Parcel E-2 (Figure 3). Surface runoff from most of the parcel flowed directly into the San Francisco Bay with the exception of runoff in the northern portion of the parcel, which flowed into catch basins which discharge into the HPNS storm sewer system and then into the San Francisco Bay (CB&I, 2016).

1.4 Climate

The climate around HPNS is characterized as partly cloudy, cool summers with little precipitation, and mostly clear, mild winters with moderate precipitation. Average temperatures vary from 50 to

60 degrees Fahrenheit, and the average humidity varies from 70 to 75 percent. Prevailing winds in the area are out of the west, west-northwest, and west-southwest. Wind strength and direction vary seasonally. Winds at HPNS are generally strongest in the mid-to-late afternoon hours, when high winds tend to blow in from the Pacific Ocean. Wind speeds average around 8 miles per hour, and wind gusts may exceed 25 miles per hour (CB&I, 2016).

1.5 Parcel E-2 Geology

The geology at the surface of Parcel E-2 consists of artificial fill material, which may contain serpentine bedrock, excavated Bay Mud, sands, gravels, construction debris, industrial debris, and sandblast waste (CB&I, 2016).

1.6 Parcel E-2 Hydrogeology

Groundwater at Parcel E-2 is present in the A-aquifer, B-aquifer, and bedrock water-bearing zone. The A-aquifer consists primarily of saturated artificial fill. The groundwater in the A-aquifer is present from 1 to 15 feet below ground surface (bgs), with generally higher groundwater levels during the wet season in winter and spring (CB&I, 2016). Additional information regarding Parcel E-2 groundwater can be found in the *Final Remedial Investigation/Feasibility Study Report for Parcel E-2 Hunters Point Shipyard San Francisco, California* (ERRG, 2011).

1.7 Parcel E-2 Hydrology

The main source of surface water runoff at HPNS is precipitation. Surface water runoff is greatest in the winter months, November through April. During this time, rainfall often exceeds 4 inches per month. Minimal runoff occurs from June through September, when precipitation is typically less than 0.1 inch per month (CB&I, 2016).

1.8 Chemicals and Radionuclides of Concern

Various chemicals of concern (COCs) and radionuclides of concern (ROCs) exist for the soil, shoreline sediment, groundwater, and landfill gas at HPNS.

1.8.1 Soil

The COCs in soil at Parcel E-2 include metals (antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, vanadium, and zinc), pesticides, PCBs, semivolatile organic compounds, total petroleum hydrocarbons, dioxins, and radionuclides. The ROCs are cesium-137 (^{137}Cs), cobalt-60 (^{60}Co) in the experimental Ship Shielding Area only, ^{226}Ra, and strontium-90 (^{90}Sr) (CB&I, 2016).

1.8.2 Shoreline Sediment

The COCs in the shoreline sediment at Parcel E-2 include metals (antimony, copper, lead, mercury, nickel, and zinc), pesticides, PCBs, and radionuclides (^{226}Ra, ^{137}Cs, and ^{90}Sr) (CB&I, 2016).

1.8.3 Groundwater

The COCs in groundwater at Parcel E-2 include metals (antimony, chromium VI, iron, lead, and thallium), pesticides, PCBs, semivolatile organic compounds, total petroleum hydrocarbons (TPH), volatile organic compounds, anions (such as cyanide, sulfide, and un-ionized ammonia), and radionuclides (^{226}Ra, ^{137}Cs, and ^{90}Sr) (CB&I, 2016).

1.8.4 Landfill Gas

The COCs in landfill gas at Parcel E-2 include methane and volatile organic compounds (CB&I, 2016).

1.9 Previous Removal Actions

Several CERCLA removal actions and other interim actions have been performed at Parcel E-2 in the past. A brush fire occurred on August 16, 2000, that burned 45 percent (approximately 14.5 acres) of the landfill surface area. The surface fire was extinguished quickly, but small subsurface fires persisted for approximately 1 month. A time-critical removal action (TCRA) was performed from 2000 to 2001 to construct an interim cap to extinguish the fire and prevent the occurrence of future fires underneath the capped area (Navy, 2012).

From 2002 to 2003 a TCRA was conducted to address the explosion hazards and human health risks associated with the off-site migration of landfill gas. The TCRA consisted of the installation and operation of a gas control, extraction and treatment system (Navy, 2012).

From June 2005 to May 2006, a TCRA was performed at the Metal Slag Area. This TCRA removed metal slag and debris containing low-level radiological material and other incidental chemical contamination. Approximately 8,200 cy of contaminated soil and sediment, 119 cy of which contained radionuclides, were excavated from this area in the southwest portion of the panhandle area (Gilbane Federal, 2017).

A Phase 1 TCRA was performed in the PCB Hot Spot Area from June 2005 to September 2006 to remove contaminated soil and debris possibly containing low-level radiological material. Free-phase petroleum hydrocarbons were also removed to the extent practical. Approximately 44,500 cy of contaminated soil, 611 cy of which contained radionuclides, were excavated from this area in the southeast portion of Parcel E-2 (Gilbane Federal, 2017).

A Phase 2 TCRA was performed at the PCB Hot Spot Area from March 2010 to November 2012 to remove contaminated soil and debris from the shoreline portion of the PCB Hot Spot Area, and other hot spots identified in the Remedial Investigation/Feasibility Study Report. Approximately 42,200 cy of contaminated soil and 6,000 cy of large debris were excavated from areas not addressed during the Phase 1 TCRA (Gilbane Federal, 2017).

A TCRA was performed at the Ship Shielding Area from May 2012 to October 2012 to remove soil and debris potentially containing low-level radiological material containing ^{60}Co in the southwestern portion of the panhandle area. Approximately 3,800 cy of soil, 120 cy of which contained radionuclides, were excavated. ^{60}Co was not identified at levels exceeding the remediation goals, however, final surveys of the ground surface indicated ^{137}Cs and ^{90}Sr activity levels that exceeded remediation goals. Further remediation of this area was designated to be performed later (Gilbane Federal, 2017).

From November 2014 to March 2016, approximately 39,004 cy of contaminated soil were excavated from the PCB Hot Spot Area within the upland area and along the shoreline of the bay. Approximately 5,324 cy of soil and debris were excavated prior to installation of the nearshore slurry wall, and 3,499 cy of material were trenched during the nearshore slurry wall installation. Materials were screened for radiological contamination. The nearshore slurry wall was successfully installed during these efforts (Gilbane Federal, 2017).

1.10 Report Organization

This RACR consists of nine sections and is organized as follows:

- Section 1.0, “Overview”—Section 1.0 provides an overview of the project, discusses site conditions and background, chemicals and ROCs, previous removal actions, and the RACR organization.
- Section 2.0, “Remedial Action Objectives”—Section 2.0 presents the RAOs for this RA.
- Section 3.0, “Remedial Actions”—Section 3.0 describes the RA pre-construction and construction remedial activities, including waste characterization and management, site surveys, and deviations from the planning documents.
- Section 4.0, “Demonstration of Completion”—Section 4.0 provides information to demonstrate completion of the Parcel E-2 Phase II RA described herein and the achievement of the RAOs for soil and solid waste that were identified in the ROD.
- Section 5.0, “Data Quality Assessment”—Section 5.0 discusses the findings of the data review and validation process for analytical and radiological data.
- Section 6.0, “Community Relations”—Section 6.0 describes the community involvement activities associated with this RA.
- Section 7.0, “Conclusions and Ongoing Activities”—Section 7.0 provides conclusions following completion of the RA for Parcel E-2 and discusses activities currently ongoing at Parcel E-2 to maintain the remedy.
- Section 8.0, “Certification Statement”—Section 8.0 presents the RACR certification statement.
- Section 9.0, “References”—Section 9.0 includes a list of documents used to compile this RACR.

The following are included as Appendices A through AA, respectively:

- Responses to Agency Comments
- Pre-Final and Final Inspection Checklist
- Construction As-Built Drawings
- Unexploded Ordinance Data
- Low-Level Radiological Waste Manifests
- Monitoring Well Network
- Field Change Requests
- Surveyor Submittals
- Photograph Log
- Low-Level Radiological Objects
- Slurry Wall Field Reports and Testing Results
- RESRAD Modeling
- Quality Control Testing Results
- Material Free Releases
- Weekly Quality Control Meeting Minutes
- Construction Submittals (with requests for information)
- Daily Contractor Quality Control Reports
- Radiological Instrument Data
- Waste Consolidation Debris
- Biological Survey Report
- Air Monitoring Data and Reports
- Survey Unit Characterization Reports
- Import Material Approval Packages
- Waste Manifest and Waste Data
- Water Quality Monitoring Results
- Radiological Screening Yard Pad Data Packages
- Analytical Data and Validation Reports

2.0 REMEDIAL ACTION OBJECTIVES

The RAOs were established in the ROD (Navy, 2012) and are based on the following:

- Attainment of regulatory requirements, standards, and guidance
- Contaminated media
- COCs and chemicals of ecological concern
- Potential receptors and exposure scenarios
- Human health and ecological risks

RAOs for Parcel E-2 are based on future open space reuse. The Navy is not seeking free radiological release of Parcel E-2 at this time (CB&I, 2016).

The soil and sediment RAOs that apply for this RA are listed as follows:

- Prevent human exposure to inorganic and organic chemicals at concentrations greater than remediation goals (Table 1) for the following exposure pathways:
  - Ingestion of, outdoor inhalation of, and dermal exposure to solid waste, soil, or sediment from 0 to 2 feet bgs by recreational users throughout Parcel E-2.
- Prevent ecological exposure to concentrations of inorganic and organic chemicals in solid waste or soil greater than remediation goals (Table 1) from 0 to 3 feet bgs by terrestrial wildlife throughout Parcel E-2.
- Prevent ecological exposure to concentrations of inorganic and organic chemicals in solid waste or soil greater than remediation goals (Table 1) from 0 to 3 feet bgs by aquatic wildlife throughout the shoreline area.
- Prevent exposure to ROCs at activity levels that exceed remediation goals (Table 2) for potentially complete exposure pathways.

The control of groundwater via the upland slurry wall and French drain, and by other remedies such as the nearshore slurry wall and upgradient well network, will address the groundwater RAOs:

- Prevent or minimize migration of chemicals of potential ecological concern to prevent discharge that would result in concentrations greater than the corresponding water quality criteria for aquatic wildlife.
- Prevent or minimize migration of A-aquifer groundwater containing total TPH concentrations greater than the remediation goal (where commingled with CERCLA substances) into the San Francisco Bay.

3.0 REMEDIAL ACTION

This section discusses the RAs what were conducted under this task for Parcel E-2 (Phase II). Background information and data related to the RAs are presented in the appendices to this RACR, as given in the following subsections. Appendix I presents photographs taken during the various stages of the RA.

3.1 Pre-Construction Activities

Pre-construction activities included permitting and notifications, meetings, biological surveying and monitoring, topographical surveys, utility surveys, and site preparation. The following subsections describe the activities that were performed in preparation for remediation work.

3.1.1 Permitting and Notifications

APTIM obtained necessary authorizations from the HPNS Caretaker Site Office (CSO) and the Resident Officer in Charge of Construction (ROICC) for performing the RA at Parcel E-2. Prior to field activities, APTIM notified the Navy Remedial Project Manager (RPM), ROICC, CSO, appropriate fire department personnel, and HPNS security as to the nature of the anticipated work.

The work was conducted in accordance with Section 121(e) of CERCLA (42 United States Code, Section 9621[e]), as amended, which states that no federal, state, or local permits will be required for the portion of removal or RA conducted entirely on site. Because this work was executed to support a RA and was conducted entirely on site, no other permits and fees were required for the RA. However, substantive provisions of applicable or relevant and appropriate requirements specified in the ROD (Navy, 2012) were fulfilled.

APTIM maintains a current annual excavation permit from the California Occupational Safety and Health Administration (Permit No. 2015-917213). Where required, 24-hour notification was provided before excavation activities began. Underground Service Alert (800 227 2600) was notified to obtain utility clearance a minimum of 72 hours prior to intrusive activities. The permits and notifications were maintained for the duration of the field activities.

Radiological work permits (RWPs) were prepared in accordance with AMS-710-07-WI-04009, "Radiological Work Permits" (APTIM, 2019), as applicable, to address the activities performed in radiological areas and included radiological conditions and safety requirements for the activities. Personnel assigned to site work were required to read and sign the RWP acknowledging that they understand the requirements of the RWP prior to beginning work. The RWPs identify the requirements for entering, exiting, and conducting work in radiologically posted areas.

3.1.2 Pre-Construction and Kickoff Meetings

A project kickoff meeting was held on September 10, 2015. Attendees included the Navy RPM, the ROICC, and APTIM personnel. The purpose of the meeting was to review the project description and objections, discuss logistics and site access, introduce the team, and review project organization and schedule.

Prior to the start of field activities, a pre-construction and mutual understanding meeting was held on July 26, 2016. Personnel attending the meeting included representatives of APTIM, the Navy RPM, the Navy ROICC, the Navy HPNS CSO, and other contracted personnel. The purpose of this meeting was to develop a mutual understanding of the remedial activities and the contractor quality control (QC) details, including forms to be used, administration of on-site work, and coordination of the construction management and production.

Upon receipt of the appropriate authorizations, field personnel, temporary facilities, and construction materials were mobilized to the jobsite on August 2, 2016. Dedicated laydown areas established in the field during mobilization, were used for short-term storage of equipment and materials. Additional pre-construction meetings were held with appropriate field personnel, subcontractors, and Navy representatives at the beginning of each definable feature of work, as specified in the contractor QC plan (Work Plan Appendix E; CB&I, 2016).

3.1.3 Construction Quality Control Meetings

Contractor QC meetings were held on a weekly basis throughout the course of fieldwork. At a minimum, the Project QC Manager with the Construction Manager, Radiological Control Supervisor, and the field foremen attended this meeting. The Navy RPM, ROICC, CSO, and other site personnel, subcontractor, and vendor representatives attended in person or via phone as appropriate. Appendix O includes weekly project QC meeting minutes.

3.1.4 Health and Safety Meetings

Daily tailgate safety meetings were held each morning prior to starting work. Construction staff, including subcontractors, attended these meetings and signed a tailgate safety meeting form. The meetings were held by the Site Safety and Health Officer and covered various safety issues. Subcontractor, inspector, agency, or Navy personnel that visit the site during the course of the day was required to review and sign the tailgate form prior to entering the work site.

3.1.5 Biological Surveying and Monitoring

A pre-construction biological survey was performed prior to implementing this RA at Parcel E-2 to address the following:

- Identifying potential bird species that are protected under the Migratory Bird treaty Act (16 United States Code Section 703) and California Fish and Game Code Section 3511 and, if such species are present, specify reasonable measures to ensure their adequate protection during implementation of the remedy.

- Determine the extent to which the wetlands restoration for the Yosemite slough restoration project may have attracted endangered or fully protected bird, mammal, amphibian, or reptile species (as identified in pertinent sections of the California Fish and Game Code) and, if such species are present, specify reasonable measures to ensure their adequate protection during implementation of this Work Plan (CB&I, 2016).

Biological monitoring and reporting were performed by a qualified biologist during mobilization, demobilization, grading, excavation, and shoreline revetment installation activities in accordance with the biological surveying and monitoring plan (Work Plan Appendix A; CB&I, 2016). Appendix T includes results of the biological surveys and daily biological inspections.

3.1.6 Topographical Survey

A pre-construction topographic survey was completed by Bellecci & Associates, Inc., under the direction of a State of California-licensed land surveyor, on April 27, 2016. Data from this survey were used to establish horizontal and vertical controls for the site, and to assess the pre-RA site topographic features, such as high points and low points. Appendix C provides the pre-construction topographic survey.

3.1.7 Utility Survey

Underground Service Alert North was contacted on August 2, 2016, before site activities were initiated, to locate publicly and privately-owned underground utilities. From August 8 through August 10, 2016, a geophysical utility survey was conducted using magnetic and electromagnetic techniques across the Parcel E-2 project site. No subsurface utilities were identified during the survey.

3.1.8 Site Preparation

Parcel E-2 work areas were protected against stormwater pollution through installation and maintenance of best management practices (BMPs), as described in the environmental protection plan (Work Plan Appendix D; CB&I, 2016). BMPs were implemented for sediment control, to minimize erosion, for tracking control, and for waste management control. Straw wattles were installed as the primary BMP for this RA to prevent stormwater on the contaminated portion of the site from leaving the site, as well as to prevent stormwater run-on from areas outside of the site. Sandbags were placed as needed in drainage control swales and at drainage control discharge points or areas with a high probability of erosion.

In accordance with the DBR (ERRG, 2014), a 2,000-foot U.S. Department of Transportation Type III offshore turbidity curtain was deployed into the San Francisco Bay for the excavations within the intertidal zone on November 30, 2016. Prior to shoreline construction activities (excavation, backfilling, and restoration), water quality monitoring for dissolved oxygen, pH, and turbidity, as well as collecting a water sample for dissolved metals, pesticides, PCBs, and gamma spectroscopy analysis, will be performed daily for a three-day period at the point of compliance (20 feet outside the turbidity curtain centrally located within the area where the turbidity curtain is anticipated to be installed). These samples will be used to establish background values in conjunction with data from previous removal and RAs at HPNS.

During shoreline construction activities (excavation, backfilling, and restoration), water quality monitoring was performed daily for dissolved oxygen, pH, and turbidity. Weekly grab samples were also collected and analyzed for metals, pesticides, PCBs, and ROC. Sampling procedures and analytical requirements were in compliance with the environmental protection plan (Work Plan Appendix D; CB&I, 2016). Appendix Y presents sample results and monitoring logs.

Dust control measures were implemented during activities involving soil disturbance or soil handling by continuously wetting the work areas in accordance with the environmental protection plan (Work Plan Appendix D; CB&I, 2016).

3.2 Phase II Remedial Activities

This subsection describes the methods and procedures that were used to complete the following Phase II construction RAs. The completed RAs were implemented in accordance with the approved Work Plan (CB&I, 2016) and included the following:

- Shoreline revetment construction
- Site grading and on-site consolidation
- Upland slurry wall and French drain installation
- Final radiological characterization survey
- Construction of foundation soil layer
- Installation of monitoring/extraction wells and piezometers
- Waste management
- Final topographic survey
- Decontamination and release of equipment and tools
- Deconstruction of radiological screening yard (RSY) pads
- Demobilization

Excavation, grading, and subsurface work was performed under unexploded ordinance construction oversight in accordance with the *Explosives Safety Submission Determination Request for the Shoreline Revetment, Site Grading and Consolidation of Excavated Soil, Sediment, and Debris, and Upland Slurry Wall, Remedial Action at Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California*

(Navy, 2015). Construction activities were implemented in accordance with the DBR design drawings (DBR Appendix B; ERRG, 2014) and project specifications (DBR Appendix C; ERRG, 2014).

3.2.1 Shoreline Revetment

The shoreline revetment was constructed in accordance with the Work Plan (CB&I, 2016) and as described in ~~the following subsections~~Sections 3.2.2 through 3.2.9.

3.2.2 Excavation of Offshore Soil and Sediment from Parcel F

To assure the integrity of the revetment structure during future remediation activities within the San Francisco Bay, additional excavations were performed into Parcel F (just outside the Parcel E-2 shoreline) prior to installation of the shoreline revetment. The excavation extended a minimum of 6 feet offshore of the proposed revetment toe to depths ranging from 1.5 to 2.5 feet bgs (As-built Drawing C2; Appendix C). Following each excavation, the wedge of material removed was backfilled using approved material imported to the site. Shoreline excavations were conducted in workable segments perpendicular to the shoreline using a Hyundai 290 long-reach excavator. A single segment was limited to the extent of shoreline, which could be completed (excavated and backfilled) within a single low tidal cycle, thus minimizing potential impact to the San Francisco Bay during construction. Excavated material from Parcel F was segregated and tracked separately from the Parcel E-2 excavation. The sampling and analysis plan (Work Plan Appendix B; CB&I, 2016) provides analytical requirements and procedures for clean fill import verifications. Appendix W provides the import material approval packages.

In situ radiological gamma surface surveys were not performed in saturated and/or underwater areas of the Parcel F excavation. Saturated soil excavated from the intertidal zone was placed in plastic lined drying cells constructed adjacent to the excavation areas. These cells were constructed to allow water to drain from the soil and into the excavation from which it was removed. Once the material was dry, it was loaded into haul trucks and transported to the RSY pads for radiological screening, as described in Section 3.3. The estimated volume of material excavated and subsequently backfilled within the Parcel F revetment toe was approximately 666 cy.

3.2.3 Upland Excavation

Soil and debris within the upland (unsaturated) area was excavated to geogrid limits shown on As-built Drawing C2 (Appendix C) to a minimum elevation of 6.5 feet above msl. The upland excavation included excavations above msl to establish the subgrade elevation for the shoreline revetment sub-construction and geogrid placement. The excavation limits and subgrade elevations were marked out in the pre-construction survey to indicate the prescribed depths required for the subgrade. Prior to commencing excavation, surface debris including rocks, concrete (temporary revetment), rebar, metal debris, wood and other refuse were removed and staged for on-site consolidation, as described in Section 3.2.12.

The excavations were completed in 12-inch lifts. Following each lift, a Radiological Control Technician (RCT) performed a radiological gamma surface survey of in situ unsaturated soil to identify and allow removal of potential contamination and/or low-level radiological objects (LLROs) as soil was excavated. Following the identification and removal of radiological materials, if present, another 12-inch lift was excavated. This process of radiological surface screening before each 12-inch lift was repeated in unsaturated soil areas until the target depth was achieved. Large-size subsurface debris, such as concrete slabs, steel, and wood, were segregated from the soil during excavation for ex situ radiological screening and processing. To minimize the potential for dust, a water truck equipped with a hose was used to mist the dry soil and debris during excavation and segregation.

Excavated soil was loaded directly onto haul trucks and placed on RSY pads for radiological processing, as described in Section 3.3. Excavated soil was not transported on shipyard roadways outside the Parcel E radiologically posted work area. Figure 4 shows the layout of the RSY pad area.

3.2.4 Geogrid Installation

After the subgrade was established and final radiological characterization surface surveys were complete, the geogrid layer (Tencate Miragrid® 22XT) was installed as continuous strips of material running perpendicular to the revetment slope, installed from the upland anchor point to the base of the revetment toe. Each strip of geogrid was installed in accordance with the design specifications as provided in the DBR (Appendix C Section 31 05 21 [ERRG, 2014]). Per the project requirements, each strip of geogrid was cut to length and placed as a single strip of material with minimal overlapping and no splicing. To help protect the geogrid, each strip of material was placed from the upland anchor point and unrolled towards the shoreline, where the final approximate 35 feet of geogrid remained unrolled above the mean high tide line. Only sections being currently installed would be fully unrolled to their design length. As sections were installed along the upland side, radiologically-cleared fill material was placed and compacted over the geogrid to match the elevation of the final cover (approximately 9 feet above msl). Fill material was pushed out over the geogrid in an upward tumbling motion to prevent wrinkles in the geogrid from folding over. Driving over the geogrid was prohibited until a minimum of 1 foot of soil cover had been placed above the geogrid layer. The final surveyed location of the geogrid layer is shown on As-built Drawing C2 (Appendix C).

The approved geogrid product data sheets and test reports were presented to the Navy in Construction Submittal #014 (Appendix P).

3.2.5 Sheet-pile Management

Protrusions within the geogrid limits were required to be cut to allow for a minimum of one foot of clearance below the final geogrid elevation. This included the temporary shoring, in the form of cantilevered ultra-composite fiberglass-reinforced plastic sheet pile, installed along the length of the Parcel E-2 shoreline by a previous (Phase I) contractor. A gas-powered chop saw was used to cut the temporary shoring wall to an elevation no higher than 3.5 feet above msl. Disturbance of the fiberglass-reinforced plastic sheet pile was initiated only after backfilling on the bay side was partially completed, to an elevation of at least 3 feet above msl, to minimize influence on the stability of the existing nearshore slurry wall. Removed portions of the sheet-pile wall were stacked in an upland area for radiological screening and disposal, as discussed in Section 3.2.12.

While performing planned subgrade excavation activities within the shoreline survey units (SUs) (Section 3.2.10), a steel sheet-pile wall was encountered approximately 1 foot below existing grade. The location and depth of this steel sheet-pile wall was determined to impact the placement of the scoped geogrid and associated anchor, thus a plan was put in place to over-excavate soil on either side of the steel sheet-pile wall to approximately 1.5 feet below the design subgrade elevation so that the steel sheet-pile wall could be cut down to the required 1 foot of clearance. The material from the excavation was transported to an RSY pad for processing while the top portion of the steel sheet-pile wall was cut using a plasma cutting tool that had been pre-tested and approved by the Navy for use in this application. Once the sheet-pile sections had been removed, the excavation foot print (sidewalls and bottom) were scanned and sampled to ensure that no radiological contamination was present. The excavation was then backfilled and compacted to the planned subgrade elevation and the removed portions of steel sheet-pile wall were surveyed for radiological release in accordance with Section 3.4.4.

3.2.6 Shoreline Excavation

In order to properly set the stone revetment along the Parcel E-2 shoreline, a keyway was first excavated from the toe of the revetment, sloped upland approximately equal to 3H:1V (1 foot of vertical rise for each 3 feet of horizontal run) from an elevation of 4.5 feet below msl to 4.5 feet above msl. Shoreline excavations were conducted in workable segments perpendicular to the shoreline using a Hyundai 290 long-reach excavator founded on the previously completed upland geogrid anchor. A single segment was limited to the extent of shoreline which could be completed (excavated and restored) within a single low tidal cycle, thus minimizing potential impact to the San Francisco Bay during construction. Saturated soil excavated from the intertidal zone was placed in plastic lined drying cells constructed adjacent to the excavation areas. These cells were constructed to allow water to drain from the soil and into the excavation from which it was removed. Once the material was dry, it was loaded into haul trucks and transported to the RSY pads for radiological screening, as described in Section 3.3. Excavation of the slope for the shoreline revetment area generated approximately 5,110 cy of sediment and debris.

3.2.7 Revetment Material Installation

Following each section of shoreline excavation, the remaining section of geogrid was unrolled from the terminus of the upland anchor to the toe of the completed keyway. Once the geogrid layer was fully installed and anchored, the excavated section of shoreline was restored with revetment material in accordance with DBR Specification 35 31 19 (ERRG, 2014). As designed, the revetment material consisted of a layer of filter fabric, followed by two layers of fragmented rock, placed independently, to provide slope stability in accordance with the DBR. The filter fabric (Mirafi 1100N), similar to the geogrid, was installed perpendicular to the shoreline only with a 2-foot overlap between each panel. The filter fabric terminated within the riprap revetment layer similar to what is shown on As-built Drawing C3 (Appendix C).

With the filter fabric in place, the initial layer of rock, designated as the filter stone layer, was installed. The filter stone layer consisted of a 1 foot 7-inch layer of filter rock, meeting DBR Specification 35 31 19 Section 2.1.3, "Filter Stone" (ERRG, 2014). Once the filter stone layer was in place, the armor stone layer was placed directly over the top. The armor stone layer consisted of a 2-foot, 10-inch layer of riprap, meeting DBR Specification 35 31 19 Section 2.1.2, "Riprap Armor Stone" (ERRG, 2014). During the installation of the armor stone, the filter fabric layer was tied into the rip rap to ensure its stabilization along the slope (top and toe).

The final revetment structure as installed is approximately 35 feet wide with a crest elevation 9 feet above msl (As-built Drawing C3; Appendix C). Approximately 2,755 tons of filter stone and 5,625 tons of armor stone was used to complete installation of the shoreline revetment at Parcel E-2. The approved riprap product data sheets and test reports were presented to the Navy in Construction Submittal #015 (Appendix P).

Appendix I includes photographic documentation of these activities.

3.2.8 Seawall and Headwall Construction

A 3-foot-tall concrete seawall was constructed at the crest of the revetment to increase the wave runup protection level along the Parcel E-2 shoreline. The goal of the concrete seawall is to protect against additional wave runup from the design storm conditions and was proposed as an alternative to placing additional soil and armor rock to reach a final design elevation of 12-feet above msl.

Yerba Buena Engineering & Construction, Inc., out of San Francisco, California, was contracted by APTIM to provide concrete services for the Parcel E-2 RA. As constructed, the concrete seawall was 1,778 feet long and has a T-profile, as shown in DBR Design Drawing S1 (ERRG, 2014). Footings were placed over an approved compacted layer of aggregate base, as specified in DBR Design Drawing S1. Care was taken during placement of the bedding material to not damage the underlying geogrid layer. The concrete seawall was reinforced using steel rebar in compliance with Technical Specification 03 30 00, "Cast-in-place Concrete," and Transmittal #003 (Appendix P) and was formed using concrete with a minimum design strength of 5,000 pounds per square inch (psi). Concrete test cylinders were collected in accordance with ASTM C31 at the frequency listed in the project specifications (ERRG, 2014). Performance testing in accordance with ASTM C39 was used to verify that the strength met the design strength. A total of 57 cylinders were tested after a 28-day curing period, demonstrating an average strength of 6,948 psi with a low of 5,590 psi. Appendix M presents verification of the design concrete strength.

A concrete headwall was constructed adjacent to the revetment structure where water from the freshwater wetlands will discharge through a solid wall high-density polyethylene (HDPE) pipe into the San Francisco Bay. As-built Drawing C2 (Appendix C) identifies the location of concrete headwall structure (which is called out as the "Freshwater Wetland Outfall"). The concrete headwall is required so that adequate cover can be placed over the pipe leading from the freshwater wetlands to the outfall without steepening the surrounding slopes, and to connect into a cut-off wall, which will prevent undercutting below the downstream face of the concrete headwall footing due to scour. The concrete headwall was completed to allow for two separate pipe penetrations which will be installed during a separate phase of the RA.

Appendix I includes photographic documentation of these activities.

3.2.9 Perimeter Channel Outlet Pipe

A perimeter channel outlet pipe was installed through the concrete seawall, running beneath the geogrid liner in accordance with the DBR (ERRG, 2014). The location of the pipe is shown on As-built Drawing C2 (Appendix C). The 20-inch DR17 solid wall HDPE pipe was installed at the elevations provided in the DBR. In accordance with Design Drawing C21 (ERRG, 2014), the pipe was installed through the previously installed nearshore slurry wall, extending inland to the outlet location (to be installed during a separate phase of the RA). The pipe ends were temporarily capped until the remainder of the outlet structure is installed. Where the outfall pipe passed through the nearshore slurry wall cap, bedding material consisting of ~~sand with a maximum particle size of 2 inches~~silty, clayey sand with gravel (Bernard Pile [Appendix M]) was used during restoration of final grade to maintain integrity of the buried pipe beneath the future service road.

3.2.10 Site Grading to Final Subgrade

Site grading was performed across much of Parcel E-2, including the landfill, site perimeter, upland panhandle area, and east adjacent area to establish the subgrade for the designed protective covers, as shown on Design Drawing C12 (ERRG, 2014). Excavations were completed in 12-inch lifts. Following each lift, an RCT performed a radiological surface survey of in situ unsaturated soil to identify and allow removal of potential contamination and/or LLROs as soil was excavated, as described in Section 3.2.11. Following the identification and removal of radiological objects, if present, another 12-inch lift was excavated. This process of surface screening before each 12-inch lift was repeated in unsaturated soil until the target subgrade elevation was achieved. 18 LLRO's were identified and removed during this surface screening process. Within the Parcel E-2 landfill SUs, the bulk of the subgrade preparation consisted of stripping 1 foot of soil from above the existing soil cover including removal of the pre-existing rock lined swale, without damaging the existing protective liner. Design Drawing C12 (ERRG, 2014) shows the extents of the grading required to prepare the subgrade across the remainder of the site. Large-size subsurface debris such as concrete slabs, steel, and wood were segregated from the soil during excavation for ex situ radiological screening and processing. To minimize the potential for dust, a water truck equipped with a hose was used to mist the dry soil and debris during excavation and segregation.

Excavated soil was loaded directly onto haul trucks and placed on RSY pads for radiological processing, as described in Sections 3.3. Figure 4 shows the layout of the RSY pad area.

Subgrade excavation volumes were estimated daily by counting the number of truckloads that were excavated and staged for radiological processing. In addition, subgrade excavation activities were documented through topographic surveys (before and after excavation). Once the final design subgrade contours were met, a final volume estimate was calculated using Autodesk Civil 3D software. Based on the final survey, a total measured volume of 112,873 cy of waste and soil was generated for reuse on the site. A graphical representation of the final subgrade cut volumes, by area, is shown on As-built Drawing C5~~4~~ (Appendix C).

3.2.10.1 Excavation to Construct Future Wetlands

The tidal and freshwater wetland areas were excavated and graded to the subgrade design as specified in the DRB (ERRG, 2014). Approximately 51,902 cy of soil, sediment and debris was excavated and radiologically screened from the tidal and freshwater wetland, as shown on As-built Drawing C5~~4~~ (Appendix C). In accordance with Work Plan Section 7.2.1.1 (CB&I, 2016), post-excavation soil samples were collected following completion of the planned freshwater and tidal wetland excavation activities. Soil samples were collected after radiological screening of the area at a rate of one sample per 50 feet of sidewall for a total of 53 samples. For every proposed bottom and sidewall confirmation sample location, a soil sample was collected and sent to an off-site laboratory for total copper, total lead, polychlorinated biphenyls and total petroleum hydrocarbons analysis. Analytical results were compared to the appropriate hot spot goals (Tiers 1, 2, and 4) listed in the CB&I Federal Services LLC (October 2016) *Final Work Plan, Remedial Action, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California* Table 1. If the chemical confirmation results exceed hot spot goals, then a step-out excavation was performed (extending vertical and horizontal limits). Where the excavation extended below 5 feet, one additional sidewall sample was be collected. In addition to the sidewall samples, one bottom sample was collected every 2,500 square feet of the excavation floor, totaling 124 samples. Figures 5 through 8 show the radiological screening and chemical sample locations summarizing the analytical strategy for the freshwater and tidal wetlands, while tables 5 through 7 summarize the progression of the chemical confirmation testing results.

As presented in Field Work Variance (FWV)-05 (summarized in Tables 5 and 6), chemical confirmation sample results exceeded the appropriate hot spot goals in sample grid locations (SU freshwater [FW]) FW-07, -08, -09, -25, -33, and -47 (Figure 5). Following the requirements of Work Plan Section 7.2.1.2 (CB&I, 2016), excavations were extended and additional confirmation samples were collected. This process was continued a second time in FW-08 and -47, and a third time in FW-25 due to some excavation sidewall samples exceeding the limit for lead. Once clean samples had been established (Figure 8), the excavation area was backfilled to achieve final subgrade elevations with on-site graded soil that has been radiologically screened and cleared for use as fill within Parcel E-2. Appendix G presents data and maps regarding these excavations is presented along with FWV-05. Groundwater that was collected during the open excavation was pumped into the freshwater wetlands area for future management.

While grading within the vicinity of the freshwater wetland, APTIM removed approximately 1,204 cy of material suspected of containing methane-generating debris. This material was segregated into its own stockpile and tarped for air sampling. Following radiological and chemical clearance, this material was moved for placement within the assigned waste consolidation area, as described in Section 3.2.12.

Placement of wetland soil and vegetation will be implemented during the final phase of construction (Phase III), which will be awarded by the Navy under a separate task order.

3.2.11 Final Radiological Characterization Surface Survey

A final radiological characterization surface survey was performed throughout Parcel E-2 to identify and remove radiological contamination to a depth of 1 foot below the final elevation of the excavated subgrade surface in accordance with the DBR (ERRG, 2014). For survey design purposes, Parcel E-2 was divided into a total of 179 Class 1 surface SUs:

- 33 SUs in the east adjacent area
- 11 SUs in the shoreline area
- 18 SUs in the freshwater wetlands area
- 17 SUs in the panhandle area
- 36 SUs in the north perimeter area
- 57 SUs in the landfill area
- 7 SUs in the tidal wetlands area

Each SU had a maximum area of 1,000 square meters and Figure 5 shows the SU layout. Data analysis was performed and a separate decision was made for each SU as to its need for remediation and/or additional data collection.

Radiological characterization surveys included a gamma scan over 100 percent of accessible unsaturated areas, static measurements, systematic sampling, and biased sampling, if required, within each SU. The follow-up static measurements utilized either the RS-700 system or a 3-inch-by-3-inch sodium iodide (NaI) detector coupled to a Ludlum Model 2221 and global positioning system unit. Follow-up static measurements were collected at locations that were identified during review of the scan data as being over the scan investigation level (IL), or identified through the tiered Radiation Solutions Inc. (RSI) data analysis process as described in the Work Plan (CB&I, 2016). Static measurements exceeding the instrument-specific IL were subjected to additional characterization using a portable gamma spectroscopy unit. If the spectroscopic results of the follow-up measurement were inconclusive in designating the material as comparable to background or naturally-occurring radioactive material, a biased sample was collected for off-site laboratory for gamma spectroscopy analysis. Saturated areas of the SUs were subjected to systematic soil sampling only and did not receive a gamma scan due to the shielding properties of water. A minimum of 18 systematic soil samples were collected from each SU and were submitted to an off-site laboratory for gamma spectroscopy analysis. Ten percent of the samples (two per SU) were also analyzed for ^{90}Sr.

Locations of soil samples with radionuclide activity in excess of the release criteria were remediated by removing the soil within 1 foot in each direction around the location, designating the material as low-level radiological waste (LLRW), and collecting bounding samples post-remediation.

Only after receiving Radiological Affairs Support Office (RASO) approval of an SU, was restoration (e.g., backfill) of an area be allowed. Section 3.2.13 describes the construction of the foundation layer using on-site cleared material. The final covers will be constructed under a future (Phase III) Navy contract and are not included in this RACR.

3.2.12 On-site Consolidation of Radiologically-Cleared Soil, Sediment, and Debris

Waste generated during RA construction and grading activities, including soil, sediment, and non-recyclable or non-reusable debris, provided it met the consolidation criteria (Table 3), was consolidated on site to establish the top of foundation layer elevation as shown in Design Drawing C13 (ERRG, 2014). Debris that was separated from soil (including concrete, bricks, timber, metal, rocks, etc) were radiologically screened in accordance with AMS-710-07-WI-40121, “Performing and Documenting Radiation and Contamination Survey” (APTIM, 2019). Radiologically-cleared debris such as concrete, bricks, timber, metal, etc., were resized and reshaped as necessary, and buried at least 5 feet below the final protective layer to minimize the potential for damage to the final cover system. This depth was specified to result in a minimum cover thickness of 7 feet over consolidated debris, corresponding to 3 feet of cover fill over the debris, 2 feet of foundation layer soil, and 2 feet of cover soil over the liner. Based on the foundation grading plan, the northwest area of the landfill was selected for the waste (i.e., debris) consolidation area because it had the greatest capacity to receive waste while meeting the waste consolidation criteria established within the DBR (ERRG, 2014).

An estimated 9,754 cy of debris was generated during grading operations; this volume was greater than the calculated capacity of the waste consolidation area designated within the DBR (Design Drawing C13; ERRG, 2014). To accommodate this larger volume of debris, APTIM proposed an increased footprint to the waste consolidation area as presented in “Request for Information 005,” issued May 1, 2018 (Appendix P). Following Navy approval on May 5, 2018, the final waste footprint shown on As-built Drawing C6~~5~~ (Appendix C) was utilized for on-site waste consolidation while meeting remaining design criteria established within the DBR.

Generated debris was segregated from soil and staged on site until it could be processed for radiological clearance. As a means of pre-processing mixed material, a Warrior 1800 Powerscreen® was mobilized to the site in February 2018. Material processed through the Powerscreen®was segregated into soil and oversized debris. Segregated soil was transported to the RSY pads for radiological screening, as described in Section 3.3. Oversized material, once radiologically-cleared, was moved for placement within the assigned waste consolidation area. Material was arranged homogeneously in 1-foot lifts using an excavator with a "thumb" attachment to avoid clustering of similar materials and to minimize void space. Following the placement of each lift, void space within pieces of debris was filled with cleared soil to reduce the risk of future differential settlement. This process was continued until the top of the waste consolidation footprint was reached (i.e., 5 feet below the proposed foundation layer) or the oversized material had been consolidated.

Materials that did not meet the consolidation criteria, or were deemed unsuitable for waste consolidation (e.g., tires, fencing, or wood debris, which could not be chipped to reduce the risk of differential settlement resulting from wood decay) were characterized and disposed of in accordance with the waste management plan (Work Plan Appendix C; CB&I, 2016). Materials characterized as LLRW were stored on site until being disposed of by the HPNS LLRW Brokering Company. Appendix E includes the LLRW waste manifests. A total of three LLROs were identified and removed during waste consolidation survey activities. Appendix J includes the LLRO information. LLROs remain secured on site and controlled by the basewide contractor pending off-site waste shipment

3.2.13 Construction of Foundation Soil Layer

After RASO approval of the final radiological characterization surveys of the excavation soil from the RSY pads, radiological cleared soil was removed from the RSY pad for reuse in construction of the final foundation layer. The foundation soil layer was constructed in lifts to the elevations shown in in Design Drawing C13 (ERRG, 2014). The foundation soil layer is 2 feet thick consisting of radiologically-cleared soil and is located directly beneath the protective liner. The final covers will be constructed under a future (Phase III) Navy contract and are not discussed in this RACR.

Fill was placed using haul trucks and a dozer to spread cleared material in lifts of approximately 1 foot at a time until the appropriate slope and elevation was reached. The surface of each lift was compacted to a minimum density of 90 perfect of the maximum dry density ±3 percent optimum moisture based on modified Proctor density testing (ASTM 1557). Density testing of shallow soil by nuclear methods was conducted at a frequency of 1/10,000 square feet per lift. Sand cone testing (ASTM D1556) and moisture testing (ASTM D2216) were conducted at a frequency of 1/150,000 square feet per lift. Site soil that did not meet the compaction requirements was reworked and retested as necessary to achieve the required design specifications. During placement of soil fill, continuous observation by a designated member of the field engineering staff ensured that materials met the suitability requirements and that moisture content was controlled to ensure compaction specifications were met. Smith-Emery Geotechnical Services, a third-party American Association of State Highway and Transportation Officials-certified geotechnical testing firm, performed geotechnical laboratory testing and field confirmatory tests. Appendix M provides compaction testing results for the re-graded subgrade.

The foundation soil layer was graded to match the slope of the final cover, which will be constructed under a future (Phase III) contract. Radiologically-cleared material from the subgrade excavation was used to construct the foundation layer. By late October 2017, APTIM completed the radiological processing and backfill placement of excavated material, but remained short of the design foundation grade in several areas across the site. In an attempt to meet the Navy's needs for this contract task order, APTIM began deconstruction of the cleared RSY pads for reuse, consolidating the pad construction material into the foundation layer as well. APTIM also used available clean fill material that had previously been placed beneath RSY pads to balance and slope the area to accommodate their original construction. An estimated total of 8,600 cy of material were used from the RSY pads after deconstruction for incorporation into the final foundation grade; however, despite this effort, the final as-built topographic survey for the site (Appendix C) has indicated that the foundation design elevations have not been met in three areas: 1) A small section of shoreline between the landfill and the geogrid anchor; 2) The area surrounding the freshwater wetland; and 3) The panhandle area (where material had been previously borrowed to complete the DBR (ERRG, 2014) requirements for the soil anchor above the geogrid liner. The final foundation grading as-built topography is shown on As-built Drawing C6 (Appendix C). The areas where there is still a soil deficiency have been graphically represented on As-built Drawing C8.

To construct the foundation layer within the freshwater and tidal wetlands area, approximately 4,620 cy of clean fill from the "Bernard Pile" in Brisbane CA was imported to the site as the soil bridge layer in accordance with DBR design drawing C19 (ERRG, 2014). Fill within the wetland areas was placed utilizing grade staking marked in the field to exactly 1 foot above the constructed subgrade surface shown on As-built Drawing C5 (Appendix C). The sampling and analysis plan (Work Plan Appendix B; CB&I, 2016) provides analytical requirements and procedures for clean fill import verifications. The approved import material transmittal package was presented to the Navy under Construction Submittal #011 (Appendix P).

3.2.14 Upland Slurry Wall Installation

The ROD (Navy, 2012) specifies that groundwater at Parcel E-2 will be controlled through the installation of two below-ground barriers; the nearshore slurry wall (installed by the Phase I contractor in 2016) and the upland slurry wall constructed under this RA. These subsurface hydraulic barriers, in conjunction with the French drain (Section 3.2.14.6) and upgradient well network (Section 3.2.15), were designed specifically to address the groundwater RAOs for the protection of wildlife specified in the ROD.

As designed, the upland slurry wall extends approximately 571 feet from the northern parcel boundary to the southern extent of the landfill waste in the western portion of Parcel E-2 (Design Drawing C5; ERRG, 2014). It is aligned perpendicular to the direction of groundwater flow in the western portion of the site to divert upgradient off-site groundwater away from groundwater that contacts landfill waste.

DBR Specification Section 02 35 27 (ERRG, 2014) established the baseline specifications for the upland slurry wall with minor variations as discussed below.

The upland slurry wall was installed by the subcontractor Geo-Solutions, Inc. (GSI), who also installed the nearshore slurry wall in 2016. GSI's mix design, and the subsequent methods for installation and QC, were identical to those approved by the Navy for installation of the nearshore slurry wall which excluded the soil component as permitted by DBR Specification Section 02 35 27, paragraph 1.1.5.2 (ERRG, 2014). The upland slurry wall was constructed by installing a self-hardening cement-bentonite (CB) slurry wall, using a slurry trenching method of construction. The CB slurry was manufactured in GSI's on-site batch plant, and consisted of a blend of slag cement, Portland cement, and bentonite. Because the slurry is self-hardening, the additional step of replacing bentonite slurry used to hold open the trench with a soil-CB (SCB) backfill was avoided, expediting the installation procedure.

As designed, the upland slurry wall is considered a "hanging" slurry wall because it was not intended to key into an aquitard. The upland slurry wall was designed to be installed from the planned finish grade, down through a thin noncontiguous lens of Bay Mud, to an elevation of approximately -10 feet below msl. Some groundwater will flow under the upland slurry wall, but groundwater modeling predictions (DBR Appendix F; ERRG. 2014) indicate that upgradient flow will mostly be diverted around the upland slurry wall or diverted to the freshwater wetland via the French drain (Section 3.2.14.7) installed on the upgradient side of the upland slurry wall.

3.2.14.1 Compatibility Testing

The slurry mix design was the same CB slurry mixture tested and approved for use with the nearshore slurry wall construction (Gilbane Federal, 2017). The slurry mix design compatibility testing was completed in accordance with DBR Specification 02 35 27, "Soil-Cement-Bentonite (SCB) Slurry Trench," (ERRG, 2014) and submitted for approval in the "Final Mix Design Report" dated October 30, 2015. For reference, the "Upland Cement-Bentonite Wall Installation, Mix Design Report" was presented for Navy approval in Construction Submittal #007 (Appendix P).

3.2.14.2 Slurry Mixing Plant

The slurry mixing plant was separated into two operations: 1) bentonite slurry preparation and 2) CB slurry preparation. The bentonite plant contained the necessary equipment for preparing the bentonite slurry including low-profile, high-shear mixers capable of producing a stable suspension of bentonite in water, hydration tanks and circulating pumps. Hydrated bentonite slurry was conveyed to the CB slurry mixing plant. This plant primarily consisted of a series of high-speed/high-shear colloidal mixers with a static agitator where slag and cement were added to the bentonite slurry to produce the final CB slurry. The batch plant was assembled by GSI near the excavation area, covering an area approximately 150 feet by 150 feet. The prepared slurry was pumped to the point of use at the trenches via fusion-welded high-density polyethylene pipe.

3.2.14.3 Materials

Water used for the slurry was drawn from a hydrant on the property. Approximately 250,000 gallons of water were used over the course of the project. The bentonite used for the slurry was premium-grade sodium montmorillonite and met the requirements of American Petroleum Institute (API) Specification 13A Section 9 for sodium bentonite for oil well drilling fluid materials. Compatibility of the bentonite with site conditions was verified through laboratory testing prior to construction. Bentonite was delivered from the supplier in 3,000- to 4,000-pound super sacks, along with the manufacturer's certification and bill of lading for each truckload. The slag cement conformed to ASTM C989 and was Grade 100 or 120, ground granulated blast furnace slag. The slag was delivered in bulk along with the manufacturer's certification and bill of lading for each truckload and was stored on site in a pneumatic tank and silo. The Portland cement conformed to ASTM C150. The Portland cement was packaged in 47- or 94-pound bags and was stored on pallets.

3.2.14.4 Cement-Bentonite Slurry Preparation

The mix design for the CB slurry was 4.5 percent Western Clay bentonite, 12 percent slag cement, 0.5 percent Portland cement, and 0.1 percent soda ash by weight of water. The CB slurry was prepared in a custom-built, continuous-cycle automated batch plant.

The bentonite slurry was prepared by mixing water and bentonite using a jet-shear mixer. The super sacks of bentonite were mounted over the material hopper, and the bentonite powder was drawn into the jet mixer via the Venturi effect. The bentonite slurry was ejected directly into a temporary storage tank where it was re-circulated until being transferred to the CB mix tank.

The CB slurry was prepared by blending the bentonite slurry with cement in a high-speed colloidal mixer and was delivered into a secondary mixing tank using a variable-speed pump. The slag was added from the silo via a screw-feed auger that was completely enclosed in the auger housing. Portland cement was added by hand through the grate at the top of the mixer. A recirculation pump with a mass-density flow meter attached to the mixing tank provided a direct read of the density of the CB mix. Periodic mud balance tests were performed as a check on the meter, in accordance with API Recommended Practice 13B-1 (API, 1997). Test results were provided in the daily reports (Appendix K). The mixed CB was pumped to the trench using a positive-cavity Moyno pump through a 6-inch HDPE pipeline. The level of the liquid in the mixing tank was monitored by sensors, and the operator maintained the water level to the maximum functional capacity.

3.2.14.5 Excavation and Installation

A working platform was constructed to meet the final grade prior to trenching and installation of the upland slurry wall. The platform required soil fill along the alignment of the upland slurry wall and was constructed to the lines and grades presented in As-built Drawing C7~~6~~ (Appendix C).

The upland slurry wall was designed to be excavated from a platform approximately 8 feet above msl to a depth of approximately 10 feet below msl using an excavator capable of excavating approximately 30 feet bgs using the slurry trenching method. The excavator was fitted with a 24-inch-wide bucket to ensure a minimum 24-inch-wide continuous trench. The trench was excavated in a series of approximately 20- to 40-foot-long cuts. The prepared slurry was introduced to the trench as the trench was excavated, to maintain sidewall stability and to minimize the intrusion of groundwater. Spoils and excess slurry from the trench removed from the excavation process were direct-loaded into dump trucks for transport to the RSY pads for radiological processing. Saturated soil was first placed in drying cells to dry prior to transport to RSY pads. The unsaturated excavated surfaces were radiologically surveyed to the extent practicable.

The working platform was surveyed to provide elevation points and the depth of the trench was measured at least every 10 lineal feet. The trench alignment and offset control points were also surveyed prior to construction activities. Survey markers with station locations were placed at 10-foot intervals along the upland slurry wall centerline. Depth measurements for each day of excavation were presented in the daily reports (Appendix K).

On October 30, 2017, GSI began mobilization activities for construction of the upland slurry wall. GSI's mobilization and site setup activities were completed on November 10, 2017. On November 13, 2017, excavation and slurry installation activities began. Excavation of the upland slurry wall proceeded as planned for approximately the first 100 linear feet of construction, after which GSI reported refusal at approximately 15 feet bgs (-1.5 feet below msl). The unknown obstruction was noted as something hard, fairly smooth and continuous, indicating the presence of a feature different than the rubble and debris encountered at the higher elevations. On November 20, 2017, digging was resumed along the original alignment at a location identified to be just beyond the noted obstruction. Digging continued without further incident and on November 22, 2017, the excavation of the remaining length of upland slurry wall construction was completed.

On November 20, 2017, there was a conference call with the Navy RPM and Navy Design Engineer (ERRG) to discuss the upland slurry wall status and what needed to be done to meet the design objectives. At the conclusion of the call the Navy representatives believed that additional investigation is necessary prior to pursuing deviation to the design with the regulatory agencies. In summary, the upland slurry wall was constructed along the designed alignment and to the prescribed depth, with the exception of a 200-foot section that came in to contact with refusal about mid-depth as shown on As-built Drawing ~~C6~~ C7 (Appendix C). Section 4.2 presents a discussion of the post-construction supplemental investigation.

After the top of the upland slurry wall hardened sufficiently, a temporary anti-dessication cap was placed on the top of the upland slurry wall. A 1-foot-thick layer of uncompacted soil was placed over the upland slurry wall by scraping material off the adjacent work platform. The final trench cover was installed after the entire alignment of the trench and temporary cover was installed. The final trench cover was installed by excavating a 2-foot-deep, 6-foot-wide trench from the surface. A small amount of soil was bermed on the outside of the excavation for the placement of backfill above the level of the work platform. The excavation was filled with CB material, which formed the final trench cover after curing.

Approximately 760 bank cy of soil and debris were excavated during the upland slurry wall construction. The excavated material was radiologically screened, as described in Section 3.1.2. The final dimensions of the upland slurry wall, as constructed, are presented on the final Upland Slurry Wall and French Drain As-built Drawing ~~C6~~ C7 (Appendix C).

Appendix I includes photographic documentation of these activities.

3.2.14.6 French Drain Installation

The French drain was constructed to divert groundwater and surface water runoff to the freshwater wetland. The French drain was installed along the upgradient (western) side of the upland slurry wall, with a minimum distance of 5 feet from the upland slurry wall, in accordance with the DBR (ERRG, 2014). The French drain consisted of a buried 4-inch perforated schedule 80 polyvinyl chloride pipe embedded within the trench filled with gravel and geofabric. Pipe cleanouts were installed every 200 feet along the alignment of the pipe to facilitate future maintenance. The drain pipe and gravel backfill around the pipe were wrapped in geotextile to filter out sediment from incoming water and to minimize potential drain clogging. The French drain was constructed as designed to an elevation of 6 feet msl at a 0 percent slope (ERRG, 2014). The final dimensions of the French drain, as constructed, are presented on the final Upland Slurry Wall and French Drain As-built Drawing C7~~6~~ (Appendix C).

Appendix I includes photographic documentation of these activities.

3.2.14.7 French Drain Outlet (Inlet Structure to Freshwater Wetland)

The buried 4-inch drain line was installed to the location shown on As-built Drawing C7~~6~~, where it has been temporarily capped pending installing a concrete aeration apron at the discharge point into the freshwater wetlands (ERRG, 2014). The flow from the French drain pipe will be monitored and managed under a future RA contract to ensure that the chemical concentrations for water entering the freshwater wetlands does not exceed surface water quality criteria. A sampling port and isolation valve will be installed in accordance with the DBR (ERRG, 2014) to allow for regular monitoring of the water, and to prevent water discharge into the wetlands if the water quality criteria are exceeded.

3.2.15 Installation of Monitoring and Extraction Wells and Piezometers

After the installation of the shoreline revetment, 4 piezometers, 3 monitoring wells, and 13 leachate monitoring/extraction wells were installed, predominantly in accordance with the DBR (ERRG, 2014). The final locations for wells and piezometers are shown on As-built Drawing C2 (Appendix C). The wells and piezometers were installed using a Geoprobe® 7720 drill rig equipped with direct-push and hollow-stem auger capabilities. Prior to auger-drilling, direct-push continuous soil cores were collected in acetate sleeves in order to log the lithology and identify the top of the Bay Mud layer. In between each auger-drill or direct-push, auger and bore equipment surfaces were radiologically surveyed to verify the absence of embedded LLRO's and surface contaminations. This equipment was also decontaminated by dry brushing to remove visible soils prior to advancing to the next location. Borehole logging was conducted by a geologist under supervision of a State of California Professional Geologist. Soil was classified using the Unified Soil Classification System (ASTM D2488), and was evaluated for grain size, soil type, and moisture content. The removed, over-burden soil was transported to the RSY pads for radiological screening as described in Section 3.3.

The depth of the screen interval for the piezometers ranged from 13 to 18 feet bgs, based on specific conditions observed in the field by the geologist. The screen length (0.020-inch slot size) was either 5 or 10 feet, depending on conditions observed in the soil cores, and targeted the A-aquifer located above the Bay Mud layer. The filter pack used for the piezometers was Monterey #3 sand and extended to approximately 3 feet above the screen interval.

Three monitoring wells were installed adjacent to the shoreline revetment as shown on As-built Drawing C2 (Appendix C). The monitoring wells were constructed with 4-inch schedule 40 polyvinyl chloride. The depth of the screen interval (0.010-inch screen slot size) for the monitoring wells ranged from 18 to 19 feet bgs; based on specific conditions observed in the field by the geologist. Each screen was 10 feet in length and targeted the A-aquifer located above the Bay Mud layer. The filter pack used for the monitoring wells was Monterey #2/12 and extended to approximately 3 feet above the top of the screen. Each well was surged prior to placing the transition seal to promote settling of the sand pack. For the three monitoring wells, ~~T~~two feet of bentonite chips were placed on top of the sand pack and were hydrated before placement of the grout; the piezometers and leachate extractions wells used a transition seal of #60 sand. The annular space of the wells ~~were~~ was grouted from the top of the bentonite seal to the ground surface, after which the grout would settle to approximately 3 feet bgs. As well completions are to be finalized by the Navy's follow-on contractor, the wells were generally left with 2 plus feet of casing sticking up above ground surface and a compression cap covering the opening. A cone or similar demarcation item was additionally left at each well location to increase visibility so as to avoid contact with any potential vehicle traffic at the site.

Thirteen 6-inch leachate monitoring/extraction wells were installed in accordance with the DBR (ERRG, 2014) approximately every 100 feet along the nearshore slurry wall alignment as shown on ~~As-built Drawing C2 (Appendix C)~~Figure 9. All extraction wells, with the exception of EX Well-013 were installed on the landfill side of the nearshore slurry wall. EX Well-013 encountered refusal on two occasions and was installed at the very end of the slurry wall alignment. The wells were constructed with schedule 80 polyvinyl chloride in conformance with the DBR. The wells extended to the depth of Bay Mud, as identified through continuous soil coring. The depth of the screen interval (0.020-inch screen slot size) ranged from 12 to 21 feet bgs; based on specific conditions observed in the field by the geologist. The filter pack used for the leachate monitoring/extraction wells was Monterey #3 sand and extended to approximately 3 feet above the screen interval. In accordance with the technical specifications of the DBR (ERRG, 2014), each of the three new monitoring wells were developed within 72 hours of their installation. (Appendix X includes data for the development water characterization.) Well sampling of the completed upgradient well network will be the responsibility of a future Navy contractor.

Soil borings and spoils from the installation of the wells were transported to the RSY pads for radiological screening. In accordance with the DBR (ERRG, 2014) the three monitoring wells were developed, and the development water was placed in 55-gallon drums. A total of ten 55-gallon drums of water were generated. Appendix X includes data for the development water characterization. Pending RASO concurrence, this water will be reused on site for soil conditioning.

Each feature within the monitoring well network (As-built Drawing C2; Appendix C) was installed in accordance with the DBR design drawings and specifications (ERRG, 2014) and was extended to the approximate elevation of the final cover grade. However, Technical Specification 33 24 13, Section 2.8, and Design Drawings C6, C7, and C27 (ERRG, 2014) call for each well to be completed with a steel lockable protective casing (well box) set in a concrete pad constructed around each well casing at the final ground level elevation. To properly anchor the previously installed geogrid, the Navy required fill material to be placed over the entire upland footprint of geogrid to the finished grade of the final cover. Per the DBR, it is understood that this material is only intended to be temporary and will be removed during Phase III of the RA to allow for installation of the final protective liners; therefore, with Navy concurrence to Field Change Request (FCR)-006, installation of the final surface well completions will be deferred to the next phase contractor.

Appendix F presents boring logs and data related to the monitoring well network installation. Appendix I includes photographic documentation of these activities.

3.3 Radiological Screening of Excavated Soil

The following subsections describe the radiological screening process of the excavated soil.

3.3.1 Radiological Surveying and Release Criteria

Several types of radiological surveys were used during the RAs, depending on the material and type of radiation being measured. Each detector had its own IL, that is, the level of radioactivity used to indicate when additional investigation may be necessary. The following subsections describe the relevant ILs or investigation methods for the RA.

3.3.1.1 3-inch-by-3-inch NaI Detector

The 3-inch-by-3-inch NaI detector was used for gamma scanning surveys of various SUs and for static measurements. Gamma scanning and static measurements collected from the reference area were used to develop instrument-specific scan and static ILs. Each IL was based on the instrument-specific mean background value plus 3 standard deviations of the mean (CB&I, 2016). Measurement locations that exceeded the instrument-specific scan IL during gamma walkover surveys were selected for follow-up static measurements, and static measurements that exceeded the instrument-specific static IL during follow-up investigations were subjected to additional characterization or biased sampling.

3.3.1.2 256-cubic-inch NaI Detector

The RSI detector system uses two large 256-cubic-inch NaI detectors and is capable of obtaining and presenting the gamma energy spectra of collected data. Gamma walkover data collected with the RSI detector system was analyzed using the tiered approach, as described in Work Plan Section 5.5.3.2 (CB&I, 2016). Locations selected for follow-ups were subjected to a one-minute static measurement with the RSI detector. Static measurements that were determined to be above background were subjected to biased sampling.

3.3.2 Radiological Screening Process for Radiological Screening Yard Pads

Excavated soil was spread onto RSY pads, each measuring approximately 104 feet by 104 feet, to an even thickness of approximately 9 inches for scanning with the RS-700 system. Thirty-seven pre-existing RSY pads were reused in order to scan the excavated material. A minimum of 18 systematic samples were collected from each RSY pad, with 10 percent of the samples also being analyzed for ^{90}Sr (two samples per RSY pad).

A gamma scanning survey of 100 percent of the accessible area was conducted with the RS-700 system for each pad. The scans were performed with the RS-700 system mounted to a motorized cart at a speed of 0.25 meters per second, with the detector maintained at a height of 15.24 centimeters above the ground, with each pass offset approximately 112 centimeters from the previous pass. The gamma scan data was reviewed using the analysis software RadAssist, where virtual detector (VD) 1 refers to both detectors summed, VD3 refers to the left detector, and VD4 refers to the right detector. Ten regions of interest (ROIs) were established for radium, radium progeny, and other naturally-occurring or anthropogenic gamma-emitting radionuclides that may be of interest (CB&I, 2016).

The data was first reviewed in RadAssist for elevated count rates. Next, the count rates for several ROIs were plotted and reviewed for peaks in the count rate. The Z-scores were calculated for each location in ROIs for VD1, VD3, and VD4. Local Z-scores using a moving average, and semi-local Z-scores using the global average but a moving average for the standard deviation, were also calculated to identify smaller areas of elevated counts or to identify elevated counts in areas with variable background (CB&I, 2016). These parameters were used to identify locations for follow-up investigations.

Follow-up investigations consisted of reacquiring the location of the elevated count rate and obtaining a one-minute static gamma count with the RS-700. The resulting spectrum was compared against the critical levels of the ROIs of interest based on the reference area spectrum to determine if activity was present above background. If a static measurement exceeded one or more critical levels for the ROIs of interest, a biased sample was collected at that location (CB&I, 2016).

Locations with elevated gamma count rates that were not attributable to naturally-occurring radioactivity were overexcavated to a minimum of 1 foot in each direction of the surrounding soil. The removed material was designated as LLRW, and if an LLRO was present, it was removed, characterized, and securely stored. A total of ~~42~~ 21 LLROs were identified ~~in~~ during screening of the RSY pads ~~and SUs~~. Appendix J contains LLRO information.

3.3.3 Release Criteria

Table 2 presents the remediation goals for radionuclides in soil and sediment, and the waste-consolidation-comparison criteria.

3.4 Waste Characterization and Management

The Parcel E-2 remedial activities generated several waste streams. These waste streams included soil and debris, low-level radioactive waste, liquid wastes, and metal debris.

3.4.1 Soil and Debris

Approximately 112,873 cy of soil were generated for reuse during the remedial activities. The soil was sampled for ROCs and COCs, as outlined in Tables 1 and 2. Soil that was radiologically and chemically cleared was used as fill material within Parcel E-2.

Approximately 9,754 cy of large debris were recovered during the excavation activities. These materials were radiologically-cleared prior to disposal within the assigned waste consolidation area (Section 3.2.12). Appendix S includes survey documentation.

A detailed summary of all material transported off-site for disposal is presented in Appendix X, which in summary includes approximately 2,310 tons of Resource Conservation and Recovery Act hazardous material[AM1]; approximately 62.43 tons of non-hazardous construction debris[AM2]; 774 cy of non-hazardous soil; and 98,380 pounds of recycled steel sheet pile.

3.4.2 Low-Level Radioactive Waste

Materials that exceeded the radiological release criteria in Table 2 were handled as LLRW. Materials that were determined to be NORM, such as fire-brick, were removed during the ex-situ soil screening process and also dispositioned as LLRW. Approximately 85 cy of soil and other materials were placed in bins as LLRW. The bins were transferred to the Navy LLRW contractor for disposal. Appendix E includes LLRW waste manifests.

3.4.3 Liquid Wastes

Approximately 20,000 gallons of liquid waste generated by pumping from the excavations supporting the cutting of the shoreline steel sheet-pile wall was contained in a frac tank. The water primarily consisted of rainwater and groundwater. Samples were collected and analyzed for project ROCs and were found to be satisfactory for reuse. Appendix X includes TestAmerica sampling results. With RASO concurrence, the water was reused on site for soil conditioning.

3.4.4 Metal Debris

Approximately 310 linear feet of steel sheet-pile wall was cut to an elevation below the design foundation grade and removed during the remedial activities. The steel sheet-pile wall sections were radiologically surveyed for release. The steel sheet-pile wall sections were designated as non-LLRW and were sent off site for recycling. Appendix N includes survey results.

During clearing and grubbing of the site, additional metal debris such as chain link fencing, railroad rails, and other assorted metal fragments were recovered. The debris was radiologically surveyed and cleared as non-LLRW prior to being sent off site for recycling.

A measured total of 150 tons of metal debris was shipped off site to Sims Metal Management in Richmond, California for recycling.

3.5 Biological Survey

Pursuant to the ROD (Navy, 2012) and as specified in the DBR (ERRG, 2014), a focused biological survey was performed in the areas to be affected by the remediation activities described in the Work Plan (CB&I, 2016), prior to implementation of the remedy. Biological surveys, sweeps, and compliance monitoring were performed by NOREAS Inc. on an as needed basis, during project activities from early August 2016 through late June 2018. The objective of this field work was to identify potential bird species and active nests that are protected under the Migratory Bird Treaty Act and the California Fish and Game Code within the study area, while recommending reasonable measures to safeguard the adequate protection of special status species and regulated biological resources in the unlikely event that they occur within the study area. Appendix T includes the results of biological surveys and daily biological inspections.

3.6 Air Monitoring

Prior to the start of earthmoving activities, air monitoring stations were set up both upwind and downwind of the construction activities. Air monitoring was performed in accordance with the dust control plan (Work Plan Appendix D; CB&I, 2016). The air was monitored and sampled for PM10 (particulate matter less than 10 microns in diameter), total suspended particulates, arsenic, lead, manganese, asbestos, PCBs, polycyclic aromatic hydrocarbons, and ROCs during earthmoving activities. Radiological air monitoring was conducted upwind and downwind of the excavations and in the immediate vicinity of each excavation site. Construction activities did not result in an exceedance of the established threshold limit values during the project. Appendix U includes air monitoring results.

Due to rain, air monitoring was not conducted on the following dates:

- December 8 through 23, 2016

- January 3 and 4, 2017
- April 12 and 13, 2017
- April 17 and 18, 2017
- November 3, 2017
- November 9 and 10, 2017
- December 4, 2017
- December 15 through 17, 2017
- December 27 through 29, 2017
- January 4 through 26, 2018
- February 26 through March 27, 2018
- April 6 through 17, 2018
- October 2, 2018

3.7 Material Potentially Presenting an Explosives Hazard

On September 18, 2017, an expended 40-millimeter shell casing was discovered in panhandle SU 11. The item was inspected and was found to be free of munitions and explosives of concern and material potentially presenting an explosives hazard. The item was also surveyed for radioactivity and was found to be releasable. The item was disposed and destroyed accordingly. Appendix D includes documentation for the item.

3.8 Final Topographic Survey

After construction activities were completed, activities were surveyed by Bellecci & Associates, under supervision of a California-licensed land surveyor, to document the final locations and elevations. Appendix H includes results of the final topographic survey and Appendix C presents the as-built drawings.

3.9 Decontamination and Release of Equipment and Tools

Equipment and personnel that exited work areas were decontaminated in designated decontamination areas located near the work boundary exits. Visible dirt was first removed from equipment using a masselin wipe. Equipment was then frisked to confirm the absence of radioactivity above control levels in Table 1 of *Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors* (Atomic Energy Commission, 1974). Larger equipment, such as mini-excavators, were dry brushed over an impermeable surface for decontamination.

3.10 Deconstruction of Radiological Screening Yard Pads

After radiological screening of materials was completed, and Navy concurrence with characterization data, the excavated materials were removed from the RSY pads, and 28 of the 37 RSY pads were subsequently radiologically screened for release. RSY pads C1 through C3 and the E RSY pads were left in place for future use by other Navy projects. The radiological screening included a 100 percent gamma walkover survey, static follow-up measurements, systematic sampling, and biased sampling if required. The area was downposted from a radiologically-controlled area for the deconstruction of the 28 RSY pads. RSY pad material that met the consolidation criteria was incorporated into the Parcel E-2. Foundation layer after deconstruction of the pads, the area was lightly graded to match existing topography, and was restored in accordance with the requirements for Parcel E-2.

Appendix Z contains the survey data reports for the deconstruction of the 28 RSY pads.

3.11 Demobilization

For demobilization, construction equipment and materials were surveyed, decontaminated, and removed, and contaminated materials were collected and disposed. Site cleaning was performed, which included repair of erosion or runoff related damage, removal of materials such as excess construction material, wood, and debris, and the removal of construction equipment and storage boxes. Demobilization also included inspection of the site, and the issuance of a certification statement (Section 8.0).

3.12 Deviations from Planning Documents

A total of six FCRs and FWVs were created and implemented during this project. FCRs and FWVs were prepared and approved to address unexpected changes or to improve production. The FCRs and FWVs include the following:

- FCR-001 (Approved): Revises Worksheet 15.1 of the sampling and analysis plan (Work Plan Appendix B; CB&I, 2016) to show laboratory reporting limits for the ROCs as Decision Level Concentration and not Minimum Detectable Concentration.
- FCR-002: Adds a paragraph to the “Screening of Excavated Soils” section of the Work Plan (CB&I, 2016) to allow for the stacking of layers on RSY pads.
- FCR-003: Adds text to the “Survey Instrumentation” section of the Work Plan to include the use of the ORTEC Trans-Spec-DX-100 portable gamma spectroscopy unit, to improve the ability to characterize anomalies as naturally-occurring radioactive material or a potential LLRO.
- FWV-04: Modifies the “Site Grading to Construct Final Subgrade” section of the Work Plan to clarify that a 12-inch layer of the interim landfill cover would be radiologically screened in place prior to excavation and grading and would be excavated in a 12-inch lift after radiological screening and sampling.

- FWV-05: Modifies the sampling and analysis plan (Work Plan Appendix B) and the "Excavation to Construct Future Wetlands" section of the Work Plan. Due to sample results exceeding the hot spot goals for lead, the excavations were extended. It also proposed the use of an alternate DoD-accredited laboratory to analyze the samples with a shorter turnaround time, due to its proximity.
- FCR-006: Seeks Navy concurrence to remove the requirement for APTIM to install the final surface well completions during this phase of construction. The Phase III contractor will inherit the responsibility for installing the final surface vault/concrete pad following the installation of the final liner system and overlying protective soil cover.

4.0 DEMONSTRATION OF COMPLETION

The ROD (Navy, 2012) specified the RAOs that were developed to protect human and ecological exposure to COCs and ROCs in solid waste or soil. Through construction of the shoreline revetment; construction of the upland slurry wall; excavation for freshwater and tidal wetlands; site grading and consolidation of excavated soil, sediment, and debris; and radiological surface scanning, remediation, and clearance, these RAOs have been achieved. The following subsections describe the demonstration of completion of the RAs for Parcel E-2.

4.1 Shoreline Revetment

The final revetment structure was installed to the lines and grades established in the DBR (ERRG, 2014) with a crest elevation 9 feet above msl as documented through field survey and shown on As-built Drawing C3 (Appendix C). Approximately 2,755 tons of filter stone and 5,625 tons of armor stone was used to complete installation of the shoreline revetment at Parcel E-2. The approved riprap product data sheets and test reports were presented to the Navy in Construction Submittal #015.

To achieve the minimum factors of safety for geotechnical practice, approximately 141,600 square feet of geogrid liner (Tencate Miragrid® 22XT) was installed as continuous strips of material running perpendicular to the revetment slope. Each strip of geogrid was installed in accordance with the design specifications as provided in the DBR (Appendix C, Section 31 05 21; ERRG, 2014). The approved geogrid product data sheets and test reports were presented to the Navy in Construction Submittal #014. To address the potential geogrid anchoring deficiency, APTIM re-excavated approximately 3,500 cy of previously cleared and placed soil from the panhandle area, placing the reallocated soil over the geogrid to the final grade contours.

A 3-foot-tall concrete seawall was constructed at the crest of the revetment to increase the wave runup protection to a final design elevation of 12 feet above msl as verified through field survey. The concrete seawall was reinforced using steel rebar in compliance with Technical Specification 03 30 00, “Cast-in-place Concrete” and Transmittal #003 (Appendix P) and was formed using concrete with a minimum design strength of 5,000 psi. Concrete test cylinders were collected in accordance with ASTM C31 at the frequency listed in the project specifications (ERRG, 2014). Performance testing in accordance with ASTM C39 was used to verify that the strength met the design strength. A Total of 57 cylinders were tested after a 28-day curing period, demonstrating an average strength of 6,948 psi with a low of 5,590 psi. Appendix M presents verification of the design concrete strength.

4.2 Upland Slurry Wall and French Drain

The upland slurry wall was installed by the same subcontractor who installed the nearshore slurry wall in 2016. The mix design, and the subsequent methods for installation and QC, were identical to those approved by the Navy for installation of the nearshore slurry wall, which excluded the soil component as permitted by DBR Specification Section 02 35 27, paragraph 1.1.5.2 (ERRG, 2014). The slurry mix design compatibility testing was completed in accordance with DBR Specification 02 35 27, “Soil-Cement-Bentonite (SCB) Slurry Trench,” and submitted for approval in the “Final Mix Design Report” dated October 30, 2015. The upland slurry wall was constructed along the designed alignment and to the prescribed depth, with the exception of a 200-foot section that came in to contact with refusal about mid-depth, as shown on As-built Drawing C7~~6~~ (Appendix C). Appendix K presents the upland slurry wall field reports and testing results.

Following the recommendation of the Navy’s design engineer, a direct-push drill rig was mobilized to the site on September 18, 2018. At total of 12 step-out locations were investigated using a 3.5-inch-diameter drive casing in an attempt to confirm the presence/absence of ~~the~~ a buried obstruction in relation to the proposed upland slurry wall alignment (As-built Drawing C7~~6~~; Appendix C). Essentially no drill cuttings were generated by the direct-push rig, nor were geotechnical samples collected. The 12 selected locations encountered difficult ~~drilling~~ driving conditions at or very near the same subsurface elevation, with 6 locations meeting complete refusal of the drill rig. These 6 locations were able to reach the design depth only after significant effort ~~in drilling~~ with no discernable limit of subsurface obstruction.

Further review of boring logs from historic documentation within the area (*San Francisco Naval Shipyard, San Francisco California, Advance Planning Report for Land Excavation and Fill, Public Works Program FY 1958* [Navy, 1958]) appear to indicate a distinct layer of serpentine weathered rock encountered approximately 10 feet bgs in the northwestern corner of the Parcel E-2 site. The information collected in the field, coupled with a historical records search would appear to indicate that obstruction encountered was geologic in nature rather than man-made; therefore, without a clear path to “step-out” the upland slurry wall, APTIM recommends leaving the slurry wall as currently constructed with no further alterations to the target depth.

4.3 Site Grading and On-site Consolidation

Site grading was performed across much Parcel E-2, including the landfill, the site perimeter, the upland panhandle area, and the east adjacent area to establish the subgrade for the designed protective covers as shown on Design Drawing C12 (ERRG, 2014). Excavations were completed by SU in 12-inch lifts. Following each lift, an RCT performed a radiological surface survey of in situ unsaturated soil to identify and allow removal of potential contamination and/or LLROs as soil was excavated as described. This process of surface screening before each 12-inch lift was repeated in unsaturated soil until the target subgrade elevation was achieved. Based on the final survey, a total measured volume of 112,873 cy of waste and soil was generated for reuse on the site. A graphical representation of the final subgrade cut volumes, by area, is shown on As-built Drawing C5~~4~~ (Appendix C).

4.4 Final Radiological Characterization Surface Survey

The 179 SUs were radiologically surveyed after the excavations were complete. During these surveys, a total of ~~17~~ 18 LLROs were identified and removed. Appendix J presents LLRO information. Appendix V provides data reports for the surveys of these SUs. Data demonstrates compliance with project remediation goals.

4.5 Construction of Foundation Soil Layer

After RASO approval of the final radiological characterization surveys of the excavation soil from the RSY pads, radiological cleared soil was removed from the RSY pad for reuse in construction of the final foundation layer. Radiologically-cleared debris such as concrete, bricks, timber, metal, etc., were resized and reshaped as necessary, and buried at least 5 feet below the final protective layer to minimize the potential for damage to the final cover system. The final waste footprint shown on As-built Drawing C6~~5~~ (Appendix C) was utilized for on-site waste consolidation while meeting remaining design criteria established within the DBR (ERRG, 2014).

Following final site grading, APTIM collected data from the completed as-built topographic survey finalized on June 10, 2019 by Bellecci & Associates (Appendix H). An engineering review of the final as-built topographic survey indicates the east adjacent, North Perimeter, and landfill areas of the site have been constructed to grade. The areas where there is still a soil deficiency have been graphically represented on As-built Drawing C8~~7~~ (Appendix C). Based on the final as-built survey for the site, a delta of 9,277 cy of fill was calculated as still required to achieve the design foundation grade presented within the DBR (ERRG, 2014).

Pre-final and final site inspections were held on site on June 11, 2019 and August 15, 2019 respectively. During the pre-final inspection, a punch list of additional work items was developed, including several items related to the condition of the final foundation soil layer. The purpose of the final 'acceptance' inspection was to verify that items identified as incomplete or unacceptable during the pre-final inspections were completed and acceptable. The final acceptance inspection included verification that punch-list items identified during the pre-final inspection were completed as discussed. These punch-list items, including deferral to import, place, and compact the estimated 9,277 cy of fill required to complete construction of the foundation layer, were verified as complete and acceptable by the Navy RPM on August 15, 2019.

Appendix B presents discussion and resolution of the pre-final and final site inspection checklist.

4.6 Installation of Monitoring and Extraction Wells and Piezometers

Each feature within the monitoring well network was installed in accordance with the DBR design drawings and specifications (ERRG, 2014) and was extended to the approximate elevation of the final cover grade. However, Technical Specification 33 24 13, Section 2.8 and design drawings C6, C7, and C27 call for each well to be completed with a steel lockable protective casing (Well Box) set in a concrete pad constructed around each well casing at the final ground level elevation. To properly anchor the previously installed geogrid, the Navy required fill material to be placed over the entire upland footprint of geogrid to the finished grade of the final cover. Per the DBR, it is understood that this material is only intended to be temporary and will be removed during the Phase III RA to allow for installation of the final protective liners; therefore, with Navy concurrence to FCR #006, installation of the final surface well completions will be deferred to the next phase contractor.

Appendix F presents boring logs and data related to the monitoring well network installation. Appendix I includes photographic documentation of these activities.

4.7 Radiological Screening of Excavated Soil

Excavated soil was placed on the RSY pads and radiologically screened, as described in Section 3.3. The soil was spread onto the 37 RSY pads in 337 lifts or ‘uses.’ 22 of the 42 LLROs were identified and removed during screening of the soil on the RSY pads. Appendix J includes the LLRO information. Appendix Z provides data reports for the surveys of each RSY. All final, non-remediated sample results demonstrate compliance with the radiological RAO and project remediation goals, and no further action is required.

4.8 Risk Modeling

Risk modeling was performed using the maximum non-remediated radiological concentration of each ROC using the software *RESRAD* Version 7.0 (Argonne National Laboratory, 2014). A conservative resident famer scenario was used, which assumed a full-time resident that grows crops in the modeled area. Radium-226 was corrected for background (0.633 picocurie per gram [pCi/g]) in accordance with Work Plan (CB&I, 2016) Section 5.7, and it was assumed to be in equilibrium with its progeny Lead-210. The other ROCs (^{137}Cs, ^{60}Co, and ^{90}Sr) were not corrected for background in the models.

Other site-specific inputs to the model include a cover of 0.61 m (2 ft) of clean soil, as the Phase III contractor for Parcel E-2 will install this soil layer. The depth of the contaminated layer was set to 0.25 m, and the density of soil was set to 1.68 g/cm^3. The modeled area was set to 1,000 square meters, the size of a SU.

The modeling resulted in a maximum excess lifetime risk that meets the risk management range of 10^{-6} to 10^{-4} for each ROC. Appendix L presents the RESRAD output reports for dose and risk. Table 4 presents the maximum dose and maximum excess lifetime risk for each ROC.

5.0 DATA QUALITY ASSESSMENT

The following subsections discuss the findings of the data review and validation process for analytical and radiological data.

5.1 Laboratory Data Quality Assessment

Appendix AA presents the laboratory data quality assessment.

5.2 Radiological Data Assessment

The following subsections describe the data quality objectives (DQOs) for radiological data and the radiological data quality assessment.

5.2.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed to define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data. The DQOs used for this project are summarized in the following subsections.

5.2.1.1 Step One—State the Problem

The HRA (Naval Sea Systems Command, 2004) identifies Parcel E-2 as radiologically impacted; therefore, radiological screening of excavated soil and excavated surfaces will be performed.

5.2.1.2 Step Two—Identify the Decision

The decision to be made is as follows: "Do the survey and sampling results support a conclusion that the residual concentrations of ROCs in Parcel E-2 results in a residual radiological risk at the final ground surface within the risk management range of 10^{-6} to 10^{-4} specified in the NCP (National Contingency Plan)?"

5.2.1.3 Step Three—Identify Inputs to the Decision

Radiological surveys will include the following:

- Soil samples/analytical data
- Gamma scan survey data

5.2.1.4 Step Four—Define the Study Boundaries

The lateral spatial boundary for this study is the project area boundaries, as shown on Figure 5. The vertical boundary of the project area is a minimum of 2.5 feet below the planned finish grade. This depth is the average estimated depth of the deepest cut to meet the subgrade elevation plan provided in the DBR (ERRG, 2014).

5.2.1.5 Step Five—Develop a Decision Rule

If the results of the survey are consistent with the release criteria (Table 2) and the ILs, then the data will be used to support a conclusion that the residual concentrations of the ROCs results in a residual radiological risk at the final ground surface within the risk management range of 10^{-6} to 10^{-4}.

If the results of the survey exceed the screening criteria, then the area will be further investigated.

5.2.1.6 Step Six—Specify Limits on Decision Errors

Limits on decision errors are set at 5 percent.

5.2.1.7 Step Seven—Optimize the Design for Obtaining Data

Operational details for the radiological survey process have been developed, as discussed in Sections 3.2.11 and 3.3.2.

5.2.2 Radiological Data Quality Assessment

Gamma walkover data was reviewed by the radiological support team for completeness prior to analysis. The APTIM Project Radiation Safety Officer reviewed survey data to determine that the data met the appropriate criteria. The Project Radiation Safety Officer also reviewed field logbooks, sample chains-of-custody, and other documentation for accuracy and completeness. Radiological instruments were subjected to response checks and operational checks prior to use. Only instruments that passed these checks were allowed to collect data on a given day. Appendix R includes radiological instrument checks and calibration information.

6.0 COMMUNITY RELATIONS

Prior to the start of work, the Work Plan (CB&I, 2016) was made available to the public at two local repositories: City of San Francisco Main Library and HPNS Library (located near the entrance to the base).

The Navy creates quarterly newsletters on HPNS projects to keep the public informed. The newsletters are a part of the Navy's ongoing Community Relations efforts; they are mailed to residents and provided to local businesses for public use.

7.0 CONCLUSIONS AND ONGOING ACTIVITIES

Conclusions and a discussion of the ongoing activities for this RA are discussed in this section. As mentioned in Section 1.0, the Parcel E-2 remedy is being implemented in three separate phases because of the large scope of required actions as detailed in the DBR (ERRG, 2014). However, as necessary for scheduling and contracting purposes, a few of the final tasks originally designated as Phase III may be separated into a new fourth phase of construction. The task order described within this completion report was the second phase, which included shoreline revetment; site grading and consolidation of excavated soil, sediment, and debris; and upland slurry wall installation. No further action is required for these RA components; however, the Parcel E-2 RA will continue in ~~the~~ subsequent phases until the full scope of the DBR has been implemented. When ~~the three~~all phases of the Parcel E-2 RA are completed, requirements of the ROD will be met and documented in the ~~third and~~ final phase RACR.

7.1 Conclusions

The RAOs listed in Section 2.0 for soil and sediment were achieved for the Phase II RA, as residual chemical and radiological contamination indicated by post-excavation confirmation sampling and screening was removed from within Parcel E-2:

- Approximately 112,873 cy of soil were generated and cleared during Parcel E-2 Phase II activities including:
  - Approximately 51,902 cy of soil, sediment, and debris from the tidal and freshwater wetland
  - Approximately 1,204 cy of material suspected of containing methane-generating debris
  - Approximately 1,782 cy of material exceeding the appropriate hot spot goal for lead
- 179 SUs, encompassing approximately 47.4 acres, were surveyed and sampled to determine as-left conditions
- 337 lifts of excavated soil were radiologically processed (surveyed and sampled) on RSY pads, prior to reconsolidating cleared soil on site
- An estimated 9,754 cy of debris and oversized material (once radiologically cleared) was moved for placement within the assigned waste consolidation area
- Off-site disposal of 2,156 tons of Resource Conservation and Recovery Act soil and 154 tons of Resource Conservation and Recovery Act concrete (Appendix X)
- 42 LLROs were identified and recovered during the project
  - 21 LLROs were found on RSY pads
  - 18 LLROs were found during radiological surveys of the SUs
  - 3 LLROs were found during waste consolidation survey activities

To protect the shoreline from erosion, thus helping to ensure the protection of the completed Parcel E-2 remedy, the shoreline revetment structure was installed in accordance with the DBR (ERRG, 2014) as described within this RACR.

Additionally, the RAOs listed in Section 2.0 for control of groundwater were met through the installation of the upland slurry wall, French drain, and upgradient well network as discussed within this RACR.

The shoreline area of Parcel E-2 is adjacent to the San Francisco Bay, which contains contaminated sediments. Contaminated sediments below the mean sea level are to be addressed by the selected remedy for Parcel F, the Navy's property offshore of HPNS (ERRG, 2014). As discussed in Section 3.2.2, an additional excavation 6 feet into Parcel F was completed to assure the integrity of the revetment structure during future remediation activities within the San Francisco Bay.

7.2 Recommendations and Ongoing Activities

Remedial activities should continue in Parcel E-2 following completion of the Phase II activities described within this RACR. The Phase III RA should include the following:

- Import, place, and compact the estimated 9,277 cy of fill required to complete construction of the foundation layer (Section 4.5), deferred from the Phase II RA; resolved June 11, 2019 during final site inspections with the Navy (Appendix B)
- Install the final upgradient well network surface completions (Section 3.2.15), deferred from the Phase II RA; resolved under Navy approval of FCR-006 (Appendix G).
- Installation of the final cover system (including soil and geosynthetics)
- Final construction and development of the freshwater and tidal wetlands
- Installation and operation of a landfill gas extraction, control, and containment system
- Final installation of site features such as service roads, drainage features, monitoring wells, and perimeter fencing; and
- Post-construction operations and maintenance

Phase III, to be completed by another contractor under a separate contract award by the Navy, is expected to be the final phase of the Parcel E-2 RA. Phase III is anticipated to be completed in 2022.

8.0 CERTIFICATION STATEMENT

I certify that this RACR memorializes completion of the construction activities to implement the RA at Parcel E-2 Phase II at HPNS, San Francisco, California specifically 1) construction of the shoreline revetment structure; 2) excavation for the freshwater and tidal wetlands; 3) site grading and consolidation of excavated soil, sediment, and debris; 4) installation of the Parcel E-2 upland slurry wall; and 5) radiological surface scanning, remediation, and clearance of the HPNS Parcel E-2 site. The RA was implemented pursuant to the ROD (Navy, 2012) and the DBR (ERRG, 2014), and in accordance with the Work Plan (CB&I, 2016), with deviations noted herein. This RACR documents the implementation of a portion of the remedy selected in the ROD, specifically the shoreline revetment; site grading and consolidation of excavated soil, sediment, and debris; and upland slurry wall installation. Recommendations and ongoing activities have been presented in detail in Section 7.2 of this RACR. No additional construction activities for this phase of the remedial design are anticipated at this time, thus these portions of the RA are deemed complete.

Mr. Derek J. Robinson, PE
BRAC Environmental Coordinator
Hunters Point Naval Shipyard

Date

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Figures

Figure 1
Site Location Map

Figure 2
Parcel E-2 Areas

Figure 3
Pre-Existing Conditions

Figure 4
RSY Pad Layout

Figure 5
SU Layout

Figure 6
Freshwater Wetland Final Chemical Confirmation Sample Grids

Figure 7
Tidal Wetland Final Chemical Confirmation Sample Grids

Figure 8
Freshwater Wetland Final Lead Excavation Final Chemical Confirmation Sample Grids

Figure 9
Foundation Grading As-Built

Tables

Table 1
Hot Spot Goals for Soil and Sediment

Hot Spot Tier	Impacted Media	COC/COEC	Hot Spot Goal (mg/kg)	Basis for Hot Spot Goal
Tier 1	Soil	Copper	4,700	10 times RG for terrestrial wildlife [a]
		Heptachlor epoxide	1.9	10 times RG for recreational users [a]
		Lead	1,970	10 times RG for terrestrial wildlife [a]
		Total PCBs	7.4	10 times RG for recreational users [a]
		Total TPH	3,500	TPH source criterion [b]
	Sediment	Copper	2,700	10 times RG for aquatic wildlife [a]
		Lead	2,180	10 times RG for aquatic wildlife [a]
		Total PCBs	1.8	10 times RG for aquatic wildlife [a]
		Total TPH	3,500	TPH source criterion [b]
Tier 2	Soil	Copper	4,700	10 times RG for terrestrial wildlife [a]
		Lead	1,970	10 times RG for terrestrial wildlife [a]
		Total PCBs	7.4	10 times RG for recreational users [a]
		Total TPH	3,500	TPH source criterion [b]
	Sediment	Copper	2,700	10 times RG for terrestrial wildlife [a]
		Lead	2,180	10 times RG for terrestrial wildlife [a]
		Total PCBs	1.8	10 times RG for terrestrial wildlife [a]
		Total TPH	3,500	TPH source criterion [b]
Tier 3	Soil	Lead	19,700	100 times RG for terrestrial wildlife [a]
		Total PCBs	74	100 times RG for recreational users [a]
		Total TPH	3,500	TPH source criterion [b]
Tier 4	Soil	Copper	4,700	10 times RG for terrestrial wildlife [a]
		Lead	1,970	10 times RG for terrestrial wildlife [a]
		Total PCBs	7.4	10 times RG for recreational users [a]
		Total TPH	3,500	TPH source criterion [b]
		Zinc	7,190	10 times RG for terrestrial wildlife [a]

Table 1 (continued)
Hot Spot Goals for Soil and Sediment

Hot Spot Tier	Impacted Media	COC/COEC	Hot Spot Goal (mg/kg)	Basis for Hot Spot Goal
Tier 5	Soil	Copper	4,700	10 times RG for terrestrial wildlife [a]
		1,1-Dichloroethane	2.8	Residential RBC (for Parcel E) [c]
		Lead	1,970	10 times RG for terrestrial wildlife [a]
		Tetrachloroethene	0.48	Residential RBC (for Parcel E) [c]
		Total TPH	3,500	TPH source criterion [b]
		Trichloroethene	2.9	Residential RBC (for Parcel E) [c]
		Vinyl chloride	0.024	Residential RBC (for Parcel E) [c]

Notes:

[a] Section 9.1.1 of the RI/FS Report (Engineering/Remediation Resources Group, Inc. and Shaw Environmental, Inc., 2011) presents RGs for recreational users, terrestrial wildlife, and aquatic wildlife. Soil goals apply to Parcel E-2 areas except for the intertidal shoreline zone (Figure 2), where sediment goals apply to material from 0 to 2.5 feet below ground surface. The 2.5-foot depth corresponds to the exposure depth for aquatic wildlife that may inhabit the intertidal shoreline zone (as documented in the screening-level ecological risk assessment presented in the RI/FS Report).

[b] TPH source criterion (Shaw Environmental, Inc., 2007). The TPH source criterion represents the most conservative evaluation criterion for potential sources of groundwater contamination that may impact aquatic wildlife in San Francisco Bay, and is selected as the hot spot goal in areas where total TPH is known to be present in groundwater at concentrations exceeding the corresponding RG (Section 9.3.1 of the RI/FS Report).

[c] Residential RBCs for the select VOCs are presented as part of the human health risk assessment for Parcel E (Barajas & Associates, Inc., 2008); these VOCs are present in Parcel E-2 and impact groundwater at Parcel E at concentrations that pose a risk to humans. These RBCs represent the most conservative evaluation criteria and are selected as hot spot goals for the purpose of maximizing the effectiveness of the VOC source removal effort and on the presumption that, based on available site data, the VOC source area is limited in volume (Figure 12-8, of the RI/FS Report).

COC	*chemical of concern*
COEC	*chemical of ecological concern*
mg/kg	*milligram per kilogram*
PCB	*polychlorinated biphenyl*
RBC	*risk-based concentration*
RG	*remediation goal*
RI/FS Report	*Final Remedial Investigation/Feasibility Study Report for Parcel E-2 Hunters Point Shipyard San Francisco, California*
TPH	*total petroleum hydrocarbons*
VOC	*volatile organic compound*

Sources:

Barajas & Associates, Inc. 2008. Final Revised Remedial Investigation Report for Parcel E, Hunters Point Shipyard, San Francisco, California. May 2

Engineering/Remediation Resources Group, Inc., 2011, Final Remedial Investigation/Feasibility Study Report for Parcel E-2 Hunters Point Shipyard San Francisco, California, May.

Shaw Environmental, Inc. (Shaw), 2007. Final New Preliminary Screening Criteria and Petroleum Program Strategy, Hunters Point Shipyard, San Francisco, California. December 21.

Table 2
Remediation Goals for Radionuclides in Soil and Sediment

Radionuclide of Concern	Exposure Scenario	
	Outdoor Worker (pCi/g)	Resident [a] (pCi/g)
^{137}Cs	0.113	0.113
^{60}Co [b]	0.252 [c]	0.252 [c]
^{226}Ra	1.0 [d]	1.0 [d]
^{90}Sr	10.8	0.331

Notes:

[a] *Residential use is not planned for Parcel E-2, but residential goals are proposed as an additional level of protection.*

[b] *^{60}Co is an ROC for the Experimental Ship Shielding Range only.*

[c] *Remediation goal for ^{60}Co was revised to support efficient laboratory gamma spectroscopy analysis of soil samples. This revised remediation goal maintains morbidity risks within the EPA-defined acceptable range and permits an exposure level that does not increase the risk of cancer from a potential exposure to ^{60}Co.*

[d] *Remediation goal is 1 pCi/g above background per agreement with EPA (established in "Final Basewide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California," dated April 21, 2006), and is consistent with the radiological-related remedies selected in the records of decision for Parcels B, G, D-1, and UC-1. The ^{226}Ra background level for surface soil is 0.633 pCi/g. The ^{226}Ra background level for storm drain and sewer lines is 0.485 pCi/g.*

^{60}Co	*cobalt-60*
^{90}Sr	*strontium-90*
^{137}Cs	*cesium-137*
^{226}Ra	*radium-226*
EPA	*U.S. Environmental Protection Agency*
pCi/g	*picocurie per gram*

Sources:

U.S. Department of the Navy (Navy), 2006, Final Basewide Radiological Removal Action, Action Memorandum for Hunters Point Shipyard – Revision 2006, Hunters Point Shipyard, San Francisco, California.

Table 3
Waste-Consolidation-Comparison Criteria

Chemical of Concern	Comparison Criteria [a] (mg/kg)
Copper	4,700
Lead	~~19,700~~1,970
Zinc	7,190
Total PCBs	74
Total TPH	3,500
1,1-Dichloroethane	2.8
Tetrachloroethene	0.48
Trichloroethene	2.9
Vinyl chloride	0.024
Heptchlor epoxide	1.9

Notes:

[a] Waste-consolidation-comparison criterion are based on hot spot goals identified in the Final Record of Decision for Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California (U.S. Department of the Navy, 2012). Excavated waste will be tracked and will be sampled for on-site consolidation for chemicals of concern based on the hot spot tier from which the material originated (i.e., waste may not be sampled for the listed chemicals of concern).

mg/kg — *milligram per kilogram*
PCB — *polychlorinated biphenyl*
TPH — *total petroleum hydrocarbons*

Sources:

U.S. Department of the Navy, 2012, Final Record of Decision for Parcel E 2, Hunters Point Naval Shipyard, San Francisco, California, November.

Table 4
RESRAD Risk Modeling Output Summary

Radionuclide	Maximum Dose (mrem/yr)	Maximum Excess Lifetime Cancer Risk
^{226}Ra	3.963	3.143 E-05
^{137}Cs	5.640 E-03	9.369E-08
^{60}Co	7.822 E-03	6.638 E-08
^{90}Sr	3.497 E-01	3.137 E-06

Notes:

^{60}Co	*cobalt-60*
^{90}Sr	*strontium-90*
^{137}Cs	*cesium-137*
^{226}Ra	*radium-226*
mrem/yr	*millirem per year*

Table 5
Freshwater Wetlands Chemical Confirmation Testing Results (Excluding Sidewall Grids FW-SW16 and FW-SW25)

Table 6
Freshwater Wetlands Lead Excavation Confirmation Sampling Results

Table 7
Tidal Wetlands Chemical Confirmation Results

Appendices A through AA

(provided on electronic copy only)

Appendix A
Response to Agency Comments
(Reserved)

Appendix B
Pre-Final and Final Inspection Checklists
(Final Inspection Pending)

Appendix C
Construction As-Built Drawings

Appendix D
Unexploded Ordinance Data

Appendix E
Low-Level Radiological Waste Manifests

Appendix F
Monitoring Well Network
(Logs and Data)

Appendix G
Field Change Requests

Appendix H
Surveyor Submittals

Appendix I
Photograph Log

Appendix J
Low-Level Radiological Objects

Appendix K
Slurry Wall Field Reports and Testing Results

Appendix L
RESRAD Modeling

Appendix M
Quality Control Testing Results

Appendix N
Material Free Releases

Appendix O
Weekly Quality Control Meeting Minutes

Appendix P
Construction Submittals
(With Requests for Information)

Appendix Q
Daily Contractor Quality Control Reports

Appendix R
Radiological Instrument Data

Appendix S
Waste Consolidation Debris

Appendix T
Biological Survey Report

Appendix U
Air Monitoring Data and Reports

Appendix V
Survey Unit Characterization Reports

Appendix W
Import Material Approval Packages

Appendix X
Waste Manifest and Waste Data

Appendix Y
Water Quality Monitoring Results

Appendix Z
Radiological Screening Yard Pad Data Packages

Appendix AA
Analytical Data and Validation Reports

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
*Comments by: Nina Bacey, California Department of Toxic Substances Control, comments dated March 5, 2020; **follow-up on July 1, 2020.***	
Comment	**Response**
1. Section 3.3.2.2, Excavation of Offshore Soil and Sediment from Parcel F – This section refers to as-build Drawing C2 in Appendix C. Drawing C2 is not complete. A portion of the Panhandle Area appears to be missing. Please include the excavated cut to the tidal wetlands area in the drawing. **[DTSC] No further comment.**	As described in Section 3.3.1 of the Design Basis Report (DBR), the removal of offshore sediment within 6 feet of the shoreline revetment structure was required to ensure its integrity during future remediation activities in Parcel F. As-built Drawing C2 in Appendix C of the RACR correctly depicts the limits of the completed shoreline revetment which does end prior to transitioning into the tidal wetlands. Similarly, the "wedge" of sediment cut from Parcel F (correctly labeled as a 1.0' cut) ends at the same location. No changes to as-built Drawing C2 are recommended.
2. Section 3.2.10 Site Grading to Final Subgrade – Please indicate in this Section how many Low-Level Radiological Objects (LLROs) were identified and removed during the site grading (17?). **[DTSC] No further comment.**	Section 3.2.10 has been revised to indicate that 18 LLRO's were identified and removed during the site grading. A new sentence has been inserted into this section to state; "18 LLRO's were identified and removed during this surface screening process."
3. Section 3.2.13 Construction of Foundation Soil Layer – a. Please indicate in this section if the soil that was used for the foundation soil layer was screened for Chemicals of Concern (COCs) in addition to Radionuclides of Concern (ROCs). b. Please indicate in this section if the foundation layer was installed within the freshwater pond and wetland area. c. Clarification is needed for the last paragraph, #1. Is the section of shoreline between the landfill and the geogrid anchor depicted in Drawing C3? d. Is the geogrid anchor the temporary soil anchor as depicted on Drawing C3? Please indicate where the design elevations have not yet been met for the three areas specified. **[DTSC] No further comment.**	a. All material generated on site during excavation to the design subgrade was analyzed for ROCs, while additional chemical characterization was only required 1) within the design wetlands area because these areas will not be covered with a protective liner, and 2) within areas designated within the DBR to remove additional hot spots. Appendix AA presents the analytical data and validation reports. All import sources used to complete the foundation soil layer were analyzed for both site COCs and former potential ROCs, the results of which can be found in Appendix W. b. For clarity, the following paragraph will be amended to Section 3.2.13: "To construct the foundation layer within the freshwater and tidal wetlands area, approximately 4,620 cy of clean fill from the "Bernard Pile" in Brisbane CA was imported to the site as the soil bridge layer in accordance with DBR design drawing C19 (ERRG, 2014). Fill within the wetland areas was placed utilizing grade staking marked in the field to exactly 1 foot above the constructed subgrade surface shown on As-built Drawing C5 (Appendix C). The sampling and analysis plan (Work Plan Appendix B; CB&I, 2016) provides analytical requirements and procedures for clean fill import verifications. The approved import material transmittal package

	was presented to the Navy under Construction Submittal #011 (Appendix P)." c. As-built Drawing C8 depicts the foundation restoration volumes along with a color scheme representation of the areas described in Section 3.2.13. A citation will be added to this section as appropriate to bring the reader's attention to the correct figure. d. Correct. The approximate 2-foot thick layer of compacted soil placed directly over the geogrid layer serves as an "anchor" to hold the geogrid layer in place during construction of the shoreline revetment. This area was constructed to the design elevation as specified; however, as described in Section 3.2.13, a small section of shoreline 'between' the landfill and the geogrid anchor point did not meet the foundation design elevation. As noted above, please see as-built Drawing C8 for the representation of this area.
4. Section 3.2.15 Installation of Monitoring and Extraction Wells and Piezometers – Indicates in paragraph six that, *"To properly anchor the previously installed geogrid, the Navy required fill material to be placed over the entire upland footprint of geogrid to the finished grade of the final cover. Per the DBR, it is understood that this material is only intended to be temporary and will be removed during Phase III of the RA to allow for installation of the final protective liners."* Clarification is needed regarding this temporary material. a. Was it screened for COCs in addition to ROCs and if so, why does it need to be removed prior to installing the final layer of material? b. Please indicate in this section the depth of this material. **[DTSC] No further comment.**	a. The compacted soil layer placed above the geogrid liner met the same placement criteria as all other compacted foundation material on site. It is referred to as a "temporary layer" because the contractor who installs the final landfill cover system (HDPE geomembrane, drainage Geocomposite, etc.) will need to remove this material to an elevation approximately 6-inches above the in-place geogrid in order to correctly anchor the cover system to the seawall foundation as specified within the DBR. b. The depth of this material varies as the finished grade slopes upward from the completed seawall to the upland anchor point; however, the geogrid was installed at a consistent elevation approximately 6.5 ft above msl. Therefore, it is anticipated the next phase contractor will need to dig out this soil layer down to a depth of approximately 7 ft above msl, leaving a minimum 6" soil layer between the geogrid and the cover materials they will be tasked with installing.
5. Section 3.4.1 Soil and Debris – It's unclear how much soil was not cleared chemically and disposed of as hazardous waste and where that waste was transported to. Though Section 7.1 does reference some material disposal. Please clarify. **[DTSC] No further comment.**	For clarity, additional language has been added to Section 3.4.1 to better describe the final disposition of soil and debris generated on site. In addition, the following paragraph has been added to the end of Section3.4.1: "A detailed summary of all material transported off-site for disposal is presented in Appendix X, which in summary includes approximately 2,310 tons of Resource Conservation and Recovery Act hazardous material;

	approximately 62.43 tons of non-hazardous construction debris; 774 cy of non-hazardous soil; and 98,380 pounds of recycled steel sheet pile."
6. Section 4.7 Radiological Screening of Excavated Soil – Indicates *"… 22 of the 42 LLROs were identified and removed during screening of the soil on the RSY pads."* Please explain what happened to the other 20 LLROs? **[DTSC] No further comment.**	Section 4.7 only discusses the radiological screening of excavated soil that took place on RSY pads. Of the 42 total LLROs that were found during the project, 21 of them were found on the RSY pads. The origins of the other 21 LLROs that were identified during the project are described in Section 4.4 (18 LLROs during radiological surveys of the SUs), and in Section 3.2.12 (3 LLROs during waste consolidation survey activities). No changes were made to the text in Section 4.7; however, Section 7.1, "Conclusions," has been revised to provide a summary total of all LLROs identified and recovered during the project.
7. Section 7.0 Conclusions and Ongoing Activities – Indicates that the Parcel E-2 remedial action will consist of three phases. If this has been recently changed to four phases, please indicate that here (first paragraph and in Section 7.2). **[DTSC] No further comment.**	As described in Section 1.0, the Parcel E-2 remedy is being implemented in phases due to the large scope of required actions as detailed in the Final DBR (ERRG, 2014). Specifically, Section 3, Page 3-2 and 3-3 of the DBR list the RA construction activities to be completed in three separate phases. For clarity, the following statement will be amended to Section 7.0, "Conclusions and Ongoing Activities": "As mentioned in Section 1.0, the Parcel E-2 remedy is being implemented in three separate phases because of the large scope of required actions as detailed in the DBR (ERRG, 2014). <u>However, as necessary for scheduling and contracting purposes, a few of the final tasks originally designated as Phase III may be separated into a new fourth phase of construction</u>. The task order described within this completion report was the second phase, which included shoreline revetment; site grading and consolidation of excavated soil, sediment, and debris; and upland slurry wall installation. No further action is required for these RA components; however, the Parcel E-2 RA will continue in ~~the~~ subsequent phases <u>until the full scope of the DBR has been implemented</u>. When ~~the three~~ all phases of the Parcel E-2 RA are completed, requirements of the ROD will be met and documented in the ~~third and~~ final phase RACR"
8. Section 7.1 Conclusions – This last bullet indicates 42 LLROs were identified and recovered during the remediation. The text of the report indicates 17 were removed during the final radiological characterization surface survey and 22 removed during the RSY pad soil screening. Please	Section 3.2.12 ("On-site Consolidation of Radiologically-Cleared Soil, Sediment, and Debris"), the fourth paragraph, discusses the remaining 3 LLROs that were identified and removed during waste consolidation survey activities.

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
*Comments by: Nina Bacey, California Department of Toxic Substances Control, comments dated March 5, 2020; **follow-up on July 1, 2020.***	
indicate in the text of the report where the other 3 LLROs were located and how handled. **[DTSC] No further comment.**	For clarity, Section 7.14, "Conclusions," has been revised with additional bullets to read as follows: • "42 LLROs were identified and recovered during the project – 21 LLROs were found on RSY pads – 18 LLROs were found during radiological surveys of the SUs – 3 LLROs were found during waste consolidation survey activities"
9. Appendix B Figure C13 – It is difficult to see the hatched area as indicated in the Note. Please revise and/or label to clarify this area of concern. **[DTSC] No further comment.**	Figure C13 (Appendix B) has been revised to include a legend defining the various hatching patterns used.
10. Appendix C – as-build Drawing C2 – In the legend, the nearshore slurry wall and the site boundary are identified with a similar broken line. DTSC recommends changing one so that it is clear where the slurry is located. **[DTSC] No further comment.**	Drawing C2 (Appendix C) has been revised to clearly differentiate the two separate line types.
11. Appendix Y – Water Quality Monitoring Data – This appendix appears to be missing the general water quality data and monitoring logs as indicated in Section 3.1.8. Please include. **[DTSC] No further comment.**	The Water Quality Monitoring Data logs have been added to Appendix Y.
12. Section 3.1.8 of the report text indicates that the field logs for monitoring general water quality during the construction activities are included in Appendix Y. The monitoring logs are not included, only charts of some field parameters and laboratory analytical reports. The field monitoring logs should be included in the appendix.	During shoreline earthmoving work (excavation, backfilling, restoration), water quality monitoring was performed daily for dissolved oxygen, pH, and turbidity; and weekly samples were collected and analyzed for Title 22 metals, polychlorinated biphenyls, pesticides, and radionuclides of concern. The turbidity curtain sample calibration and collection logs were amended to Appendix Y [Water Quality Monitoring Results] as part of the revisions made to the Draft RACR, presented as "NEW_Water Quality Data log.pdf" during the email issuance of Draft Final RACR documents. The turbidity curtain sample collection logs, which will be fully incorporated into Final RACR Appendix Y, present the daily monitoring results for dissolved oxygen, pH, and turbidity. Furthermore, these logs indicate the dates where the required weekly samples were collected which in turn corollate to the previously mentioned laboratory reporting and monitoring results.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Nina Bacey, California Department of Toxic Substances Control, comments dated March 5, 2020; ***follow-up on July 1, 2020.***	
13. The charts provided in Appendix Y and the associated data should be reviewed because it appears that the data lines loop back to older data. The charts should be prepared as scatter plots so that the data are presented in chronological order along the x-axis. It's also recommended that the data be presented with straight lines as the smoothed lines can create this looping effect.	The Appendix Y charts representing Water Quality sample results for Dissolved oxygen, pH, and Turbidity have been revised to better represent the data in chronological order.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Marikka Hughes, California Department of Toxic Substances Control, Geological Services Unit, comments dated February2 8, 2020; ***follow-up on June 16, 2020***	
Comment	**Response**
1. Section 3.2.1 Shoreline Revetment This section states that details of the shoreline revetment construction are described in the "following subsections," but there are no subsections associated with Section 3.2.1 and the remaining sections in Section 3.2 also refer to the installation of the upland slurry wall and wells and piezometers. It is believed that the statement in Section 3.2.1 is meant to refer to Sections 3.2.2 through 3.2.13. Please review the document and revise as appropriate.	This section has been revised to read as follows: "The shoreline revetment was constructed in accordance with the Work Plan (CB&I, 2016) and as described in Sections 3.2.2 through 3.2.9."
2. Section 3.2.10.1 Excavation to Construct Future Wetlands The RACR discusses that confirmation samples were collected and exceeded in some of the sample grid locations, but the data are not presented in a table nor is a figure provided where these samples were collected. Please provide a table in the RACR that includes the confirmation sample data and also provide a figure that indicates where the confirmation samples were collected.	The Tidal and Freshwater Wetlands confirmation tabulated data was presented in Appendix X. However, for better clarity, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland and Freshwater Wetland confirmation sampling forward to the main text. Specifically, several lines of text have been added to Section 3.2.10.1, introducing new Figures 5 through 8 which show the radiological screening and chemical sample locations summarizing the analytical strategy for the freshwater and tidal wetlands, as well as new Tables 5 through 7 which summarize the progression of the chemical confirmation testing results.
3. Section 3.2.12 On-site Consolidation of Radiologically-Cleared Soil, Sediment, and Debris The text indicates that the materials generated at the site for this remedial action exceeded the volume planned in the *Final Design Basis Report, Parcel E-2, Hunters Point Naval Shipyard, San Francisco, California* (ERRG, 2014) and a reference to the changes made to the site plan are presented in Appendix C. As the figures provided in the main portion of the RACR include what the pre-existing conditions were at the site, please provide a figure of the site with the different areas post-construction labeled in the main portion of the RACR.	For continuity, a version of the Foundation Grading As-built (Drawing C6 [Appendix C]) will be copied forward to the main portion of the RACR as Figure 9.
4. Section 3.2.14.5 Excavation and Installation and Section 4.2 Upland Slurry Wall and French Drain Section 3.2.14.5 indicates that an obstruction was noted during the excavation to install the slurry wall, and later in Section 4.2, it is stated that	There are no photographs available of the subsurface obstruction as the cement-bentonite slurry used to maintain the trench excavation in an "open" condition was always required to be kept within two feet of the working surface. Reference to the historical documentation used to deduce

the obstruction is believed to be serpentinite rock. Please provide any photographs of the obstruction available and references to the documents used to determine that this obstruction is likely bedrock.	a geologic obstruction (Navy, 1958) was provided within the last paragraph of Section 4.2.
5. Section 3.2.15 Installation of Monitoring and Extraction Wells and Piezometers a. The third paragraph indicates the monitoring wells were installed with a transition seal of bentonite chips, but based on the boring logs included in Appendix F, a bentonite seal was not placed in any of the wells. Please evaluate and revise the RACR as needed. **[DTSC] The response indicates that the boring logs in Appendix F were updated to state that a bentonite transition seal was installed. While some of the wells do show a bentonite seal, a number of the wells indicate that the transition seal was #60 sand. It is recommended that the text be revised to indicate that the transition seals used in the well and piezometer construction were either #60 sand or bentonite.** b. In the last sentence of the third paragraph, the text states that "the wells were grouted from the top of the bentonite seal to the ground surface." Please revise this sentence to state that the well annular space was grouted. c. The only figure included with the well locations is provided in Appendix C. It is recommended that a figure showing the locations of the new wells and piezometers is included in the main body of the RACR. d. The RACR indicates that the wells and piezometers were not completed with a surface completion to protect the well, but there is no indication of how the wells are currently completed at the surface and how these locations are being protected while additional work needs to be completed at the site. Please revise the RACR to indicate what condition the wells were left in and what measures have been taken to protect the wells. e. The text does not indicate when the new wells will be developed and samples. Please revise the RACR to state when well development and well sampling will occur.	a. The Draft boring logs for the monitoring wells initially included in Appendix F have been updated to accurately reflect a transition seal of bentonite chips. For clarity, the statement in question has been revised to read: "For the three monitoring wells, two feet of bentonite chips were placed on top of the sand pack and were hydrated before placement of the grout; the piezometers and leachate extractions wells used a transition seal of #60 sand." b. The sentence was revised as follows: "…the annular space of the wells was grouted from the top of the bentonite seal to the ground surface." c. For continuity, a version of the Foundation Grading As-built (Drawing C6 [Appendix C]) will be copied forward to the main portion of the RACR as Figure 9. This new figure will be used to present the new upgradient well network. d. For clarity, the following statement has been added to Section 3.2.15, "As well completions are to be finalized by the Navy's follow-on contractor, the wells were generally left with 2 plus feet of casing sticking up above ground surface and a compression cap covering the opening. A cone or similar demarcation item was additionally left at each well location to increase visibility so as to avoid contact with any potential vehicle traffic at the site." e. For clarity, the following statement has been added to Section 3.2.15, "In accordance with the technical specifications of the DBR (ERRG, 2014), each of the three new monitoring wells were developed within 72 hours of their installation. (Appendix X includes data for the development water characterization.) Well sampling of the completed upgradient well network will be the responsibility of a future Navy contractor."

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
*Comments by: Marikka Hughes, California Department of Toxic Substances Control, Geological Services Unit, comments dated February2 8, 2020; **follow-up on June 16, 2020***	
[DTSC] The revision to the Report states that the sampling of the new wells is the responsibility of a future Navy contractor, but as the wells and the remedy have been installed, monitoring of these wells should begin immediately so as to understand how groundwater conditions change after the excavations and installation of the slurry wall. The Navy should secure a contractor to begin monitoring at these wells immediately.	This comment has been brought to the attention of the Navy RPM. No further changes to the Parcel E-2 Phase II RACR are recommended.
6. Section 3.4.1 Soil and Debris This section discusses the wastes that were generated, but does not provide details on how much material was disposed of off-site or placed in the waste consolidation area at the site. Please revise the RACR to include details on where the wastes went and what volumes were disposed of off-site and on-site in one section of the text.	For clarity, additional language has been added to Section 3.4.1 to better describe the final disposition of soil and debris generated on site. In addition, the following paragraph has been added to the end of Section 3.4.1: "A detailed summary of all material transported off-site for disposal is presented in Appendix X, which in summary includes approximately 2,310 tons of Resource Conservation and Recovery Act hazardous material; approximately 62.43 tons of non-hazardous construction debris; 774 cy of non-hazardous soil; and 98,380 pounds of recycled steel sheet pile."
7. Section 3.9 Decontamination and Release of Equipment and Tools This section does not provide a discussion of how the drilling rig and downhole equipment were decontaminated. Please revise to state what decontamination measures occurred during the installation of the wells and piezometers. **[DTSC] Additional text was added to Section 3.2.15 that states that augers and drilling equipment were dry-brushed between drilling locations to remove visible soils before moving to the next location. This is inadequate decontamination between well locations as not all potential contaminants are removed simply by brushing the drilling equipment and augers. Drilling wells involves advancing into groundwater, the lack of an adequate decontamination could cause cross-contamination. Additionally, after advancing into groundwater, the augers and downhole equipment would have encountered wet soils, which cannot be dry-brushed unless the soils on the equipment were permitted to completely dry beforehand. In the future, it is recommended that**	Additional text has been added to Section 3.2.15 Installation of Monitoring and Extraction Wells and Piezometers. This comment has been documented and will be reviewed for all decontamination of future drilling equipment and augers.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Marikka Hughes, California Department of Toxic Substances Control, Geological Services Unit, comments dated February2 8, 2020; ***follow-up on June 16, 2020***	
decontamination of downhole equipment involve a steam cleaning or triple rinse with a non-phosphate detergent.	
8. Appendix F Monitoring Well Network (Logs and Data) a. It is recommended that a table providing the well construction data for the wells and piezometers installed be provided in the RACR. b. The well construction diagrams on all boring logs except for EX WELL-001 do not provide details regarding the two uppermost materials placed in the annular space. Please revise the diagrams to identify what materials were used in the construction of these wells and piezometers. c. On the boring log for EX WELL-001, there is a backfill material indicated beneath the well construction materials. Please revise the log to indicate what this material is.	a. A summary table providing the well construction data for the wells and piezometers installed has been amended to the start of Appendix F. b. The draft boring logs have been updated to accurately provide well construction materials for all wells and piezometers included within Appendix F. c. The subject boring log has been updated to accurately reflect well construction materials.
9. Figure 6 Freshwater Wetland Final Chemical Confirmation Sample Grids **a) An explanation of what the red font in the sample results should be added to the legend.** **b) In the sample result boxes, some of the results are labeled with "N," "E," "S," and "W." While these appear to represent which sidewalls were sampled, these labels should be defined in the legend.** **c) A hot spot goal is provided only for lead on this figure, when other constituent results are presented on this figure. The hot spot goals for copper, total petroleum hydrocarbons (TPH), and polychlorinated biphenyls (PCBs) should be included as notes on this figure.**	For clarity, the following notes have been added to Figure 6. a) Results shown in **red** indicate samples exceeding the project action limit. b) A list of abbreviations has also been added to Figure 6 to include: F – Freshwater Wetlands Confirmation Sample EB – Excavation Bottom Confirmation Sample SW – Excavation Sidewall Confirmation Sample N – North E – East S – South W – West Mg/kg – milligram per kilogram Pb – Lead PCB – Polychlorinated Biphenyl TPH – Total Petroleum Hydrocarbons Cu – Copper c) Hot spot goals for Cu, TPH, and PCBs have been added as recommended.

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
*Comments by: Marikka Hughes, California Department of Toxic Substances Control, Geological Services Unit, comments dated February2 8, 2020; **follow-up on June 16, 2020***	
10. Figure 7 Tidal Wetland Final Chemical Confirmation Sample Grids **a) An explanation of what the red font in the sample results should be added to the legend.** **b) A hot spot goal is provided only for lead on this figure, when copper results are also presented on this figure. The hot spot goal for copper should be included as notes on this figure.** **c) Only two sample locations are indicated on this figure, when a sample should have been collected from each sample grid. This figure should be revised to include all sample locations.**	For clarity, the following notes have been added to Figure 7. a) Results shown in **red** indicate samples exceeding the project action limit. b) Consistent with Figure 6, hot spot goals for Cu, TPH, and PCBs have been added to the Legend. c) The CAD layer showing the additional sample locations was inadvertently turned off. This oversite has been corrected. d) Consistent with the changes made to Figure 6; a list of abbreviations has also been added to Figure 7 to include: T – Tidal Wetlands Confirmation Sample EB – Excavation Bottom Confirmation Sample SW – Excavation Sidewall Confirmation Sample N – North E – East S – South W – West Mg/kg – milligram per kilogram Pb – Lead PCB – Polychlorinated Biphenyl TPH – Total Petroleum Hydrocarbons Cu – Copper

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Jesse Negherbon, California Department of Toxic Substances Control, Engineering and Special Project Office, comments dated March 4, 2020; ***follow-up on June 29, 2020***	
Comment	**Response**
1. Section 3.2.9 Perimeter Channel Outlet. The fifth sentence states that bedding material consisting of sand with a maximum particle size of two inches was used during final grade restoration where the outfall pipe passed through the nearshore slurry wall cap. However, we note that the described two-inch material would classify as gravel and that the maximum sand particle size per the Unified Soil Classification System (USCS) is 4.75 millimeter. The text should be revised to include the correct description of the bedding material used and the relevant construction specification should be cited. **[DTSC] No further comment.**	For clarity, the noted statement has been revised to read as follows: "Where the outfall pipe passed through the nearshore slurry wall cap, bedding material consisting of silty, clayey sand with gravel (Bernard Pile [Appendix M]) was used during restoration of final grade."
2. Section 3.2.14.5 Excavation and Installation The first sentence in the seventh paragraph states that approximately 760 cubic yards (cy) of soil and debris was excavated during the upland slurry wall construction. It is not clear if these are bank or excavated cubic yards, and if the slurry wall cap excavation materials are included. Based on the described slurry wall configuration, our calculations indicate a total bank cubic yardage of more than 100 cy above the reported number. The volume of excavated soil and debris should be reviewed and revised, if necessary, to conform to the slurry wall configuration. **[DTSC] No further comment.**	The excavated volume of material removed during construction of the upland slurry wall has been confirmed as approximately 760 [bank] cubic yards. This volume does not include material used to construct the final trench cover which, as described in the paragraph above, took place after the entire alignment of the trench and temporary cover was installed.
3. Section 4.2 Upland Slurry Wall and French Drain The second sentence in the third paragraph states that information collected during installation of the slurry wall together with a historical record search indicates that the obstruction encountered at a depth of about ten feet along an approximate 200-foot section of the slurry wall alignment is geologic rather than man-made. The sentence further states that Aptim recommends leaving the slurry wall as constructed without further alterations to the target depth. However, we note that the text does not discuss the field data and nature of any samples obtained to support the geologic nature of the obstruction or how the requirement to key in the slurry wall into the underlying bay mud was met. The text should be revised to include a discussion of the field sampling data/information and the effect of	As described in the final paragraph of Section 3.2.14, the upland slurry wall is considered a "hanging" slurry wall because it was not intended to key into an aquitard. A two-foot key into the underlying bay mud layer was only a requirement for the nearshore slurry wall which was installed by a previous contractor in 2016. As discussed within the final DBR, some groundwater will flow under the upland slurry wall, but groundwater modeling predictions (DBR Appendix F; ERRG. 2014) indicate that upgradient flow will mostly be diverted around the upland slurry wall or diverted to the freshwater wetland via the French drain (Section 3.2.14.7) installed on the upgradient side of the upland slurry wall. As described under Section 4.2, paragraph 2, of the Phase II RACR, a Direct Push rig was used in an attempt to map a path around the perceived

terminating the slurry wall on top of/within the obstruction and whether/how this termination meets the approved design. **[DTSC] No further comment on keying of the slurry wall into bay mud. However, no description of the obstruction material is included in the text. The second paragraph states that 12 step-out locations were investigated using a direct push drill rig to assess the obstruction in accordance with a recommendation from the Navy. The text states that difficult drilling conditions were encountered with six locations meeting complete refusal and six locations advancing to the design depth with difficulty. The text does not include any information on the material(s) encountered at any of the 12 locations. The text should be expanded to include a summary of the materials encountered at each of the 12 locations, or at the very least, the materials encountered at the six locations that were advanced to the design depth.**	obstruction, not to reanalyze the subsurface strata as defined within the DBR. Unlike rotary drilling, drill cuttings were not removed from the hole, nor were geotechnical samples collected. For clarity, the second paragraph of Section 4.2 has been revised to read as follows: "Following the recommendation of the Navy's design engineer, a direct push drill rig was mobilized to the site on September 18, 2018. At total of 12 step out locations were investigated using a 3.5 inch diameter drive casing in an attempt to confirm the presence/absence of **~~the~~** **a** buried obstruction in relation to the proposed upland slurry wall alignment (As built Drawing C7; Appendix C). **Essentially no drill cuttings were generated by the direct-push rig, nor were geotechnical samples collected.** The 12 selected locations encountered difficult **~~drilling~~** **driving** conditions at or very near the same subsurface elevation, with 6 locations meeting complete refusal of the drill rig. These 6 locations were able to reach the design depth only after significant effort **~~in drilling~~** with no discernable limit of subsurface obstruction."
4. Table 3 Waste-Consolidation Comparison Criteria The comparison criteria value for lead is shown as 19,700 milligrams per kilogram. However, this value is ten times that shown in Table 1 Hot Spot Goals for Soil and Sediment. This value should be reviewed for accuracy and revised accordingly. **[DTSC] No further comment.**	Table 3 of the Draft (Phase II) RACR does indeed contain a typo in that the Hot Spot Goal for lead should read 1,970 (mg/kg). This table will be reviewed and revised for accuracy during the Final (Phase II) RACR submittal. Please note that while this table does contain a typo, the correct value of 1,970 mg/kg was used during the lead soil investigation summarized in Appendix X.
5. Appendix C Construction As-Built Drawings. Drawing C2 Shoreline Revetment Finish Grading As-Build The nearshore slurry wall shown on the drawing is on the order of 1200 feet long. However the nearshore slurry wall described in the report text is indicated to be on the order of 571 feet. In addition, the drawing does not show all the existing features, specifically Drawing C1 Pre-Existing Site Conditions shows at least three pre-existing monitoring wells that are proximal to the alignment of the nearshore slurry wall and which are not shown in Drawing C2. In addition, Drawing C2 shows 13 extraction wells	As stated in the first paragraph of Section 3.2.14: The ROD (Navy, 2012) specifies that groundwater at Parcel E-2 will be controlled through the installation of two below-ground barriers; the nearshore slurry wall (installed by the Phase I contractor in 2016) and the upland slurry wall constructed under this RA. Therefore, all references to slurry wall installation within this RACR should be in reference to the 'upland' wall, which extends approximately 571 feet from the northern

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
Comments by: Jesse Negherbon, California Department of Toxic Substances Control, Engineering and Special Project Office, comments dated March 4, 2020; follow-up on June 29, 2020	
which are not shown in Drawing C1, and are not discussed in the report. The drawings and report should be reviewed for consistency and revised accordingly. **[DTSC] Drawing C2 shows the near-shore slurry wall installed as part of Parcel E-2 Phase I construction. The drawing also shows monitoring wells installed as part of Phase II construction, the subject of the current RACR. The drawing does not show the location of the upland slurry wall installed as part of the Phase II construction. The Drawing C2 title block is also labeled "Parcel E-2 As-Builts". The RTC refers to Section 3.2.14 Upland Slurry Wall Installation for a description of the location of the upland slurry wall. However, we note that the upland slurry wall does not appear to be depicted on any as-built drawings. The Phase II remedial action completion report as-built drawings should clearly show the features installed as part of the Phase II remedial action so that they are distinguishable from pre-existing features.**	parcel boundary to the southern extent of the landfill waste in the western portion of Parcel E-2. The as-built location of the nearshore slurry wall (Phase I, 2016) is shown on Drawing C1, Pre-Existing Conditions, as well as the location of the monitoring well network as it existed prior to initiation of the Phase II RA. Drawing C2 shows the as-built installation of the nearshore slurry wall and newly installed upgradient well network (Section 3.2.15) which included the installation of 4 piezometers, 3 monitoring wells, and 13 leachate monitoring/extraction wells. As-built Drawing C2 [Shoreline Revetment Finish Grade As-Built] was only intended to show the as-built conditions at the shoreline. As described throughout Section 3.2.14 of the RACR, the as-built conditions of the upland slurry wall are presented on As-Built Drawing C7. The surveyed location of the upland slurry wall is also shown at a larger scale on As-Built Drawing C6 [Foundation Grading As-Built], which is considered the final Phase 2 site condition.
6. Appendix C Construction As-Built Drawings. Drawing C6 Foundation Grading As-Built The contours shown on this drawing differ from those shown on Drawing C2 Shoreline Revetment Finish Grading As-Built. The text report states that Phase II remedial action completion left finished grades as foundation layer grades. The drawings should be reviewed and revised to remove the discrepancies. **[DTSC] The drawing was not included in the most recent submittal. However, the contours on Drawing C2 appear to have been updated to match Drawing C6, as stated in the RTC. We have no further comment.**	As-built Drawing C2 was only intended to show the as-built conditions at the shoreline, while as-built Drawing C6 represents the final as-built conditions of the foundation grade. However, to help avoid confusion, the contours shown on as-built Drawing C2 have been updated to the final foundation grade as suggested within the figure title.
7. Appendix C Construction As-Built Drawings. Drawing C7 Upland Slurry Wall and French Drain As-Built. The Profile View Alignment – (Upland Slurry Wall) shows a bottom slurry wall elevation of about – 10.00 feet with an approximate 200-foot section with a bottom elevation of elevation 0.00 feet. Note 1 associated with the profile states that the Bay mud for the section is noncontiguous and not considered an aquitard. However, we note that the third sentence in the second paragraph in Section 3.7.2.2 Wall Depths of the August 2014 Final Design Basis Report, Parcel E-2 states that	As-built Drawing C7 is a true and correct representation of the upland slurry wall which is described in the final paragraph in Section 3.7.2.2 of the DBR (ERRG, 2014). As described in the DBR, "The upland slurry wall will be installed from the designed finish grade, down through a thin noncontiguous lens of Bay Mud (identified in the boring logs as clay with shell fragments), to an elevation of approximately -10 feet below msl." The details described in paragraph two of Section 3.7.2.2 of the DBR are

	the bottom elevation of the nearshore slurry wall varies between -6 and -20 feet below msl based on the location of the underlying Bay Mud aquitard, stated in the first sentence of the same paragraph. The as-built condition appears to be a deviation from the Design Basis Report (DBR), and it is not clear if the Bay Mud aquitard was engaged. The as-built condition should be evaluated against the DBR and the implications of not engaging the underlying Bay Mud should be evaluated, in relation to the effectiveness of the nearshore slurry wall, and the conclusion(s) in the third paragraph in Section 7.1 Conclusions should be revised as necessary. **[DTSC] Drawing C7 was not provided for review. The RTC states that as-built drawing C7 is a true and correct representation of the upland slurry wall. However, we note that the profile section shows the bay mud as extending across the obstruction encountered on an approximate 200-foot section of the slurry wall. This depiction appears to be incorrect as the direct-push drilling completed to evaluate the obstruction reported either complete refusal or difficult drilling which does not appear to support the presence of bay mud within the obstruction. We recommend the profile section is revised to show the correct as-built location of the bay mud layer and the notes are expanded to include an explanation of the obstruction encountered during installation, and hence the deviation from the approved design.**	in reference to the nearshore slurry wall which, as previously discussed, was installed by the Phase I contractor in 2016. As cited within the legend of Drawing C7, the approximate depth to bay mud presented for this section was as defined in the final DBR (ERRG, 2014). Furthermore, the notes on Drawing C7 state that the bay mud layer for this section is noncontiguous and not considered an aquitard. Since the upland slurry wall was designed as a hanging wall, i.e., it was not intended to key into an aquitard, subsurface investigation for the purpose of mapping the location of the bay mud layer in this area is considered outside the scope of the Phase II contract. No additional changes to Drawing C7 are recommended; however, if requested, all references to the subsurface stratum as defined within the DBR may be removed. See also response to Comment #3.
8.	Appendix M Quality Control Testing Results The Daily-Compaction Test Report by Smith-Emery San Francisco dated 7/5/18 presents 13 field compaction test results all marked as passing. However, the specified relative compaction is shown as 95% and all the test results are between 91 and 93 percent of the maximum dry density which indicates that all the test results failed to meet the compaction specification. All the reported test results should have been indicated as failing and the appropriate box below the results table should have indicated that the material tested did not meet requirements of the jurisdiction approved documents. The compaction test report should be revised to address and resolve the discrepancy and a discussion on the implications of the failed compaction tests on the performance of the associated work should be included in the report.	As specified in the final DBR for Parcel E-2 (ERRG, 2014); "Soil cover material at depths greater than 0.5 foot below the final cover surface will be compacted to 90 percent or greater of the maximum dry density at or near optimum moisture, in accordance with ASTM International (ASTM)-modified proctor density testing." References in the Daily-Compaction Test Report by Smith-Emery citing a compaction specification of 95% are in error and the reported test results ranging between 91 and 93 percent of the maximum dry density were correctly reported as passing test results. The compaction test reports in Appendix M will be reviewed and revised, as necessary, to resolve this discrepancy.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Jesse Negherbon, California Department of Toxic Substances Control, Engineering and Special Project Office, comments dated March 4, 2020; follow-up on June 29, 2020	
[DTSC] The relevant revised pages from Appendix M were provided via email. The compaction requirement was revised from 95 to 90%. No further comment.	
9. Appendix O Weekly Control Meeting Minutes. Project QC Meeting Notes from QC Meeting 45 (08.29.2017) The bolded text at the bottom of Item 5 states that compaction was not performed during backfilling because the backfilling work was shoreline work and there were no compaction requirements. However, our review of As-Built Drawing C5 Subgrade Excavation Volumes shows that 204 cubic yards of fill was placed in conjunction with the revetment and As-Built Drawing C3 Shoreline Revetment Detail shows “Compacted foundation” below the geogrid. The meeting note indicates that the DBR requirement was not followed and additionally that the “Compacted foundation” text in As-Built Drawing C3 is in error. The As-Built drawing should be revised accordingly and the implications of the presence of an uncompacted foundation layer, at least locally, on the long-term performance of the revetment should be evaluated. **[DTSC] Appendix O was not provided for review. The RTC notes that the shoreline revetment construction did not begin until April 2018. The RTC states that the Project QC Meeting Notes from the 8/29/2017 meeting discuss backfilling in the tidal wetlands and panhandle area. The RTC further states that backfilling along the shoreline should be in reference to the Tidal Wetlands. The RTC did not indicate if the meeting notes were revised in the final version. The RACR was prepared for Parcel E-2 Phase II construction and material discussing features outside of the RACR scope should be clearly identified for clarity and completeness of the RACR/administrative record. We recommend notations/footnotes are included to identify material outside of the RACR scope.**	Please note that construction of the shoreline revetment did not begin until April 2018 (QC Meeting 76, 04/10/2018). Project QC Meeting Notes from QC Meeting 45 (8/29/2017) discuss backfilling in the tidal wetlands and panhandle area. Thus, backfilling along the shoreline in this context should be in reference to the Tidal Wetlands. As-Built Drawing C5 Subgrade Excavation Volumes correctly shows a fill of 0 cubic yards placed within the Tidal Wetland during construction of the Subgrade surface. No revisions to the Project QC Meeting Notes from 8/29/2017 have been made. As presented within the notes from QC meeting #45, work for the week from 08/21/2017-08/28/2017 included Backfilling in the tidal wetlands area and the panhandle areas. The comment in question, which was the result of a question posed by the Navy ROICC Shirley Ng, would have been representative of work to be accomplished on the date of her inspection. The response provided by APTIM’s PQCM Chris Hanif, was correct provided he was referring to the tidal wetland area, specifically those areas below the tide line. For consistency with the regulatory comment, As-Built Drawing C3, the Shoreline Revetment detail, has been re-labeled as “native foundation” where appropriate. Section 7.2 of the Final RACR was previously revised to include all recommendations and future activities to be completed as part of the Phase III RA.
10. Appendix O Weekly Control Meeting Minutes. Project QC Meeting Notes from QC Meeting 49 (09.26.2017) The bolded text at the end of Item 5 refers to brick as Naturally Occurring Radioactive Material (NORM) and states that the tentative plan was to leave the bricks in place. The Comments/Questions section after Item 11 in the	The data which identifies and documents the brick material as NORM was provided in the RACR Appendix W Survey Unit Characterization Reports. As an example, see North Perimeter SU 01, 02, 03, 04, 05 and 09 Hunters Point Naval Shipyard, Parcel E-2 Radiological Characterization of Subgrade Data Report.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Jesse Negherbon, California Department of Toxic Substances Control, Engineering and Special Project Office, comments dated March 4, 2020; ***follow-up on June 29, 2020***	
Project QC Meeting Notes from QC Meeting 53 (10/24/2017) indicates that fire brick was left in place in the North Perimeter. The Comments/Questions section after Item 11 in the Project QC Meeting Notes from QC Meeting #81 (5.15.2018) states that fire brick was NORM and was thereby not subject to Navy cleanup. Although we recognize that manufactured brick may contain NORM, the basis for exempting the manufactured brick materials from removal and disposal at this site is not clear. We also note that the handling and final disposition of the bricks is not discussed in the RACR text. The RACR text should be revised to include the data that identifies and documents the brick materials as NORM, a description of the basis for not removing them during the remedial action, and a discussion of how the bricks were handled and their final disposition. **[DTSC] Appendix O was not provided for review. The RTC states that Section 3.4.2 was revised to include how the bricks were handled and their final disposition. We find that revised text in Section 3.4.2 addresses the handling and final disposition of the bricks adequately. We recommend notations/footnotes are included in Appendix O for clarity and completeness.**	A discussion of how the bricks were handled and their final disposition has been added to Section 3.4.2, Low-Level Radioactive Waste, which was revised to read as follows: "Materials that exceeded the radiological release criteria in Table 2 were handled as LLRW. Materials that were determined to be NORM, such as fire-brick, were removed during the ex-situ soil screening process and also dispositioned as LLRW. Approximately 85 cy of soil and other materials were placed in bins as LLRW. The bins were transferred to the Navy LLRW contractor for disposal. Appendix E includes LLRW waste manifests." Appendix O includes the weekly Quality Control Meeting Minutes for the project. These meeting minutes include a summary of the week's activities for Navy review, as well as discussions/opinions related to ongoing and planned future work. While it is understood that certain planned activities and discussion may change, especially as new information is obtained, these meeting minutes are believed to be an accurate record of the referenced meeting as it occurred. It is the purpose of the Final RACR to document the "as-built" condition of the site and all Remedial Activities as they occurred. No additional changes are recommended to the Project QC Meeting Notes in Appendix O.

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
Comments by: Tami LaBonty, California Department of Fish and Wildlife, Office of Spill Prevention and Response, comments dated March 6, 2020; ***follow-up on June 16, 2020***	
Comment	**Response**
1. Appendix T. Please label all photographs with the date, a brief description of the photo, and the direction the photo was taken where appropriate. **Comment # 1. The response to Comment # 1 is noted.**	Appendix T includes results of the biological surveys and daily biological inspections as prepared by NOREAS Inc. to support the remedial action performed by APTIM. The daily biological monitoring form attached with each set of photos provide a date and a brief summary of activities for the day. No additional changes to the photographs are recommended at this time.
2. Page T-41. The version of Appendix T that we received starts on page T-41. Are pages T-1 to T-40 supposed to be included in Appendix T? **Comment # 2. The response to Comment # 2 is accepted.**	Appendix T, 2,547 pages in total, should begin with page T-1 and end with page T-2,547. Future submittals of this Appendix will be verified for completeness prior to re-submittal.
3. Pages T-114 to T-130. The Daily Biological Monitoring Forms dated 1/1/17 and 1/18/17 are out of sequence in the appendix. These forms are included between the forms dated 1/26/17 and 4/03/17. Please rearrange the forms and associated photographs into chronological order. **Comment # 3. The response to Comment # 3 is accepted.**	The daily biological monitoring forms in Appendix T have been reviewed and rearranged into chronological order as appropriate.
4. Page T-585 and T-696. The Daily Biological Monitoring Forms indicate nesting American Avocets have been observed at two distinct active nest sites and a 50 foot activity exclusion buffer was being maintained around both nests (first indicated on the form dated 5/31/17 for the first nest site, and on 6/12/17 for the second nest site). Please include photographs of these two nests sites with the corresponding monitoring forms, if available.	APTIM has received a Memo dated 4/24/2020 from NOREAS, their biological subcontractor, that includes photographs of the two nest sites. The Memo is provided as an attachment to this RTC file (Appendix A).
5. Page T-1972. From page T-1972 forward, please check the dates on the Daily Biological Monitoring Forms to ensure they are correct and revise as needed. Some of the forms are dated with the year 2016 instead of 2017. Some of the forms have the same day of the month (e.g., page T-1979 11/2/17 and page 1994 11/2/16).	Appendix T has been reviewed and revised to address any inconsistencies.
6. Page 1-1, Section 1.0. Overview, First Paragraph. Please remove the period before colon in last sentence.	The text will be revised as noted.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Karen Ueno, US Environmental Protection Agency, comments dated March 6, 2020	
Comment	**Response**
1. U.S. EPA supports DTSC's comments on the draft RACR that were submitted to the Navy on 03/05/2020 and which are attached for convenience. EPA attempted not to repeat DTSC's comments except for particularly important concerns.	Comment noted.
2. Section 3.2.10.1 indicates that there are more than the apparent 6 FWV/FCR identified in Section 3.12. Correct this discrepancy and include clear descriptions in the RACR of all work variances and change requests and their approval status.	Section 3.2.10.1 introduces the acronym Field Work Variance (FWV), of which there are two: FWV-04 and FWV-05. Section 3.2.10.1 also introduces the acronym for Survey Unit freshwater (FW). The two acronyms, while similar, are not interchangeable.
3. Section 4 includes many FWV/FCRs, but no clear indication of approval status. The RACR needs to clearly identify all FWV/FCR and their approval status. See comment, above.	As summarized in Section 3.12, Deviations from Planning Documents: A total of six FCRs and FWVs were created and implemented during this project. FCRs and FWVs were prepared and approved to address unexpected changes or to improve production. Each of the listed FCRs and FWVs under Section 3.12, along with their corresponding Navy approval, are presented in Appendix G. Note, the first five FCR/FWVs were signed off for approval by the Navy RPM, while the final FCR (-006) was approved via email provided for reference in Appendix G.
4. "Recommendations and Ongoing Activities" needs to clearly identify all Phase II work being deferred to the Phase III contractor, with cross-references to the approved FWV/FCR.	For clarity, Section 7.2, Recommendations and Outgoing Activities has been revised to include the following two new bullets: • "Import, place, and compact the estimated 9,277 cy of fill required to complete construction of the foundation layer (Section 4.5), deferred from the Phase II RA; resolved August 15, 2019 during final site inspections with the Navy (Appendix B) • Install the final upgradient well network surface completions (Section 3.2.15), deferred from the Phase II RA; resolved under Navy approval of FCR-006 (Appendix G)"
5. The Navy's "Certification Statement" should acknowledge the FWV/FCRs approved by the Navy, called out in the RACR (including design changes), and the specific Phase II work deferred to Phase III. Otherwise the certification is less meaningful and could be misconstrued as construction completed as originally designed.	For clarity the text of Section 8.0, Certification Statement, has been revised to read as follows: "I certify that this RACR memorializes completion of the construction activities to implement the RA at Parcel E 2 Phase II at HPNS, San Francisco, California <u>specifically 1) construction of the shoreline revetment structure; 2) excavation for the freshwater and tidal wetlands; 3) site grading and consolidation of excavated soil, sediment, and debris; 4)</u>

	installation of the Parcel E-2 upland slurry wall; and 5) radiological surface scanning, remediation, and clearance of the HPNS Parcel E-2 site. The RA was implemented pursuant to the ROD (Navy, 2012) and the DBR (ERRG, 2014), and in accordance with the Work Plan (CB&I, 2016), with deviations noted herein. This RACR documents the implementation of a portion of the remedy selected in the ROD, specifically the shoreline revetment; site grading and consolidation of excavated soil, sediment, and debris; and upland slurry wall installation. Recommendations and ongoing activities have been presented in detail in Section 7.2 of this RACR. No additional construction activities for this phase of the remedial design are anticipated at this time, thus these portions of the RA are deemed complete.”
6. As indicated in Section 4.2, the slurry wall does not meet design specifications due to a subsurface obstruction. This appears to be a substantive design deviation. The RACR needs to identify the FWV/FCR that documents the change. The RACR also needs to adequately demonstrate, aside from a reference to a 1958 report, that weathered serpentine rock is creating the obstruction and why no alteration to the slurry wall is necessary to accommodate for such weathered obstruction.	As designed, the upland slurry wall is considered a “hanging” slurry wall because it was not intended to key into an aquitard. While the RACR does document an approximate 200-foot section of the wall which was unable to obtain the full depth of design, the wall through this section was cut as deep as practical into the geologic feature encountered. Further evaluation of the groundwater modeling predictions presented as part of the DBR (Appendix F; ERRG. 2014) is considered outside the scope of this contract. See also response to San Francisco Bay Regional Water Quality Control Board comment #15.
7. Was the survey discussed in Section 4.4, performed with QA by an independent source?	During implementation of the Parcel E-2 RA, a third-party contractor (Battelle) was hired by the Navy to monitor and oversee the radiological data process and evaluation. While Battelle did not perform physical over-check surveys of the post excavation SU’s, they did periodically perform visual observations of APTIM’s in-process field surveys.
8. In Section 4.5, 9,277 cubic yards of fill will be deferred to Phase III. Identify the FWV/FCR that support this change and include the deferred activity, cross-referenced to the appropriate FWV/FCR, in “Recommendations and Ongoing Activities.” See comments, above.	For clarity, the final sentence of paragraph three to Section 4.5 has been revised to read as follows: “These punch list items, including deferral to import, place, and compact the estimated 9,277 cy of fill required to complete construction of the foundation layer, were verified as complete and acceptable by the Navy RPM on August 15, 2019.” See also response to comment #4 above.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Karen Ueno, US Environmental Protection Agency, comments dated March 6, 2020	
9. Section 4.6 states that well completion is pending removal of rock and placing of concrete collars on the wells (FCR 6 approved these changes). Include the deferred activity, cross-referenced to the appropriate FWV/FCR, in "Recommendations and Ongoing Activities." See comments, above.	Concur. See response to comment #4 above.
10. In Section 4.8, demonstrate how the as-built condition of the cover remains protective given the risk modeling and the as-built conditions.	The risk modeling presented is in accordance with the approved Remedial Action Work Plan, Section 5.7 Risk Modeling, was to "perform risk modeling to demonstrate the radiological risk at the final ground surface." This directive is also in accordance with the Navy's Statement of Work issued in support of this Contract Task Order (N62473-12-D-2005), which states the Contractor shall, "…perform risk modeling that will demonstrate the radiological risk at the final ground surface (following installation of a demarcation layer and soil cover performed by others) is within the risk management range specified in the NCP (10-6 to 10-4)." Risk modeling for the interim site conditions, i.e., prior to installation of the final cover system, is considered outside the scope of this contract.
11. The Remedial Design Package (Remedial Action Monitoring Plan, Land Use Control Remedial Design, Operation and Maintenance Plan, and Construction Quality Assurance Plan) will need to be updated and/or revised prior to and after the Phase III project, including final landfill gas collection and control system and monitoring program and the leachate collection and control system.	Comment noted This work is beyond the scope of this contract. Any follow-on work will be addressed by the Navy.
12. The standard practice in closing bayshore landfills where waste is partially under groundwater (with or without slurry wall containment) is to maintain an inward gradient from the Bay to the fill by pumping leachate and monitoring the gradient. We note that inboard extra wells have been constructed. The complete extraction and pumping system should be included in Phase III.	Comment noted This work is beyond the scope of this contract. Any follow-on work will be addressed by the Navy.
13. Has evaluation of the required pumping rates to maintain an inward gradient been completed or planned? If discharge of leachate to POTW is planned, the quality of the leachate should be characterized prior to the construction to verify the need for a pre-treatment, and discussion initiated to establish the viability and feasibility of obtaining a permit.	Comment noted This work is beyond the scope of this contract. Any follow-on work will be addressed by the Navy.
14. Description of as-built design changes from approved plans and specifications is a standard requirement for construction but they are not	The RACR provides Section 3.12, Deviations from Planning Documents to describe as-built design changes from the approved plans and

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Comments by: Karen Ueno, US Environmental Protection Agency, comments dated March 6, 2020	
found in the RACR, nor in the plans and specification as red markups. There are a few red markups, but they are not legible. The RACR should include a section describing design changes, and full markup of the plans and specifications.	specifications. Reviewing, editing, or otherwise marking up the Navy's approved plans and specifications is beyond the scope of this contract.
15. Please verify the removal and proper disposal of the construction and demolition debris that are noted in Appendix X (Waste Manifest Data) as still on-site.	The material in question was not removed from site until after the submittal of the Draft (Phase II) RACR. To finalize this table, the Date of Transportation for Construction Debris, (RSY pad plastic and Building 258 general debris), has been revised to read: "December 6, 2019."
16. Appendix X Waste Manifest and Waste Data a. The information and presentation don't clearly verify that soils and other wastes were managed appropriately and that the remediation goals of Tables 1-3 were met. Summary tables with sampling data and statistics (and/or prior investigation results) compared with non-hazardous thresholds where the waste was managed as non-hazardous would be helpful, as would verifying that the sampling data remediation goals have been met. The manifest copies are not signed. b. It appears that the Tidal and Freshwater Wetlands Confirmation Testing results indicate locations where hot spot goals were exceeded (red color). Please clarify and if true, describe the actions taken or to be taken to address these exceedances.	a. The final version of Appendix X has been revised to include an updated Table, Summary of Waste Materials from Parcel E-2, showing the final disposition of all off-site waste streams accompanied by a tabulated summary of the supporting waste sample results. Waste manifests will be reviewed to ensure the final signed versions are represented. b. No soil exceeding lead criteria were left in the excavation of the Tidal Wetlands and Freshwater Wetland. For better clarity of work completed in these areas, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland and Freshwater Wetland excavation, confirmation sampling and figures forward to the main text.
17. Appendix AA (Draft Soil Data, Laboratory Data Quality Assessment Summary Report). The PCB results for sample TW-EB-T66-001 were rejected. Section 1.5 states, "Surrogate recoveries were less than 10% for some PCB samples, all detected compounds were qualified as "J-" and all non-detected compounds as "R". The second surrogate was within control limits. Although the data were qualified as estimated due to noncompliant surrogate recoveries, data usability was not affected." The RACR does not provide a figure identifying the locations and depths of collected samples or table summaries of the final results. It appears from the sample nomenclature, that this sample was collected in the Tidal Wetland (TW) area (Figure 5). Assuming this is a sediment sample, the "Hot Spot Goal" per Table 1 is 1.8 mg/kg for PCBs in sediment. Please address how these unusable data affected the soil and sediment remedial action goals specified in Section 2.0 of the RACR.	Further investigation of laboratory raw data was subsequently performed based on the "rejection" findings in the validation report. The laboratory narrative reported surrogate recovery was affected by "evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed." PCB analysis is performed using 2 columns and detectors for confirmation purposes. The laboratory primarily reports from Column A. The severe interference and low recovery were observed with Column A analysis. Column B results showed less interference and higher surrogate recovers (19.2%), which is above the data validation rejection criteria. Both columns indicate PCBs were not detected in the sample. The final results will be reported from Column B, with J (estimated) qualifier to indicate matrix interference with possible low bias, but still usable for project decisions.

Response to Comments on the *Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047*	
Comments by: Karen Ueno, US Environmental Protection Agency, comments dated March 6, 2020	
	EPA protocol also states to "Use professional judgment in qualifying data, as surrogate recovery problems may not directly apply to target analytes."
18. Additional comments on the rad portions of the RACR may be forthcoming, as appropriate.	The CDPH RHB Branch has no comments per March 5, 2020 letter from DTSC, Juanita Bacey.

Response to Comments on the ***Draft [Final] Remedial Action Completion Report, Parcel E-2 Phase II, Hunters Point Naval Shipyard, San Francisco, California, June 2020, DCN: APTM-2005-0013-0047***	
Comments by: Jeff White, San Francisco Bay Regional Water Quality Control Board, comments dated March 6, 2020; ***follow-up on August 7, 2020***	
Comment	**Response**
1. Section 3.2.10.1, Excavation to Construct Future Wetlands Bottom excavation was extended 5 feet laterally and 1 foot deeper due to a post-excavation bottom sample analytical result exceeding a hot spot cleanup goal. This resulted in an over-excavation volume of less than 1 cubic yard (yd^3). This bottom soil volume removed is not commensurate with the in-situ soil volume represented by the failed sample analytical result (93 yd^3). According to the Phase II Remedial Action Work Plan (Phase II RAWP) on page 7-9, soil was to have been "removed along the exposed sidewall face a maximum of 25 feet on each side of a failed sidewall sample (and 2 feet outward)," due to a post-excavation sidewall sample analytical result exceeding a hot spot cleanup goal. Yet, according to the Phase II RACR, soil was removed 5 feet on each side of a failed sidewall sample, resulting in an over-excavation volume of approximately 3 yd^3. This sidewall soil volume removed (3 yd^3) is not commensurate with the in-situ soil volume represented by the failed sample analytical result (15 yd^3). Comment 1: Although over-excavation dimensions generally follow the approved Phase II RAWP, we are concerned that over-excavation of contamination was not extensive enough to achieve the hot spot goals throughout the Freshwater Wetland and, consequently, residual pollutants may impact the health of the Freshwater wetland and the Bay.	No contamination was left in place. The over excavation process started with a 5' lateral step out on each side of exceeding sidewall sample and a 2 feet step back (deep). Then 3 additional confirmation samples were collected from the new sidewalls step out. If the lateral distance of 5' was not sufficient, the step out sample would identify further excavation was necessary until the final limits of contamination were bounded (see new WP Figure 8). This process did work to expose sidewalls requiring further excavation, as described in the additional lead excavation performed in the Freshwater Wetland Grid F25.
2. The Phase II RACR states on page 3-10 that "chemical confirmation results exceeded the appropriate hot spot goals in sample grid locations (SU freshwater [FW]) FW-7, -08, -09, -25, -33, and -47 (Figure 5)." The survey unit (SU) grid shown on Figure 5 is not the sampling grid layout shown on multiple figures presented in Appendix G and Appendix X, which was used for cleanup of Freshwater Wetland soil. a. Refer to the appropriate figures and sample grid system b. There was a hot spot goal exceedance for lead at grid location F46. Describe this hot spot goal exceedance and remedial action. c. At grid locations F22 and F29, there were hot spot goal exceedances for combined total petroleum Hydrocarbons (TPH; or summed gasoline-range hydrocarbons [TPH_{GRO}] and motor oil-range hydrocarbons	The Radiological Survey Unit Grids are not the same as the Freshwater and Tidal Wetlands excavation chemical confirmation sampling grids. No soil exceeding lead or TPH criteria were left in the excavation of the Tidal Wetlands or Freshwater Wetland. Exceedances were removed. For better clarity, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland and Freshwater Wetland excavation, confirmation sampling to the main text.

[TPH_{MORO}]). Describe these hot spot goal exceedances and remedial actions.	
3. It is unclear why summed concentrations of TPH_{GRO} and TPH_{MORO}, rather than TPH_{DRO} and TPH_{MORO}, were used for comparison of soil sample analytical results to the TPH hot spot goal. Please explain.	Total TPH concentrations are calculated by adding all three TPH results (TPH_GRO, TPH_DRO and TPH_MORO) concentrations. Reporting limits for results qualified as not detected (U) are not additive. e.g. 35J + 45U + 35 = 70 35J + 45J + 35U = 80J 35U + 45U + 35U = 45U The data tables have been reviewed and revised to correct addition errors as necessary.
4. It is unclear why 9 to 11 months elapsed between initial confirmation sampling and follow-on, step-out confirmation sampling, as was the case at grid locations F22, F29, and at other locations. Extended exposure of TPH-contaminated soil to the elements (sun, wind, rain) may explain apparent cleanup to levels below the TPH hot spot goal when, in reality, residual TPH-contaminated soil remains in the Freshwater Wetland. Explain the long duration of time between sampling events at grid locations F22, F29, and at other locations. It may be necessary to resample at TPH-contaminated locations to demonstrate attainment of the TPH hot spot goal.	The long duration between initial excavation and remediation is a product of the danger associated with sampling a very large area that is excavated to bay mud. 95% of the samples collected required mechanical assistance through the use of an excavator. The length of time between initial confirmation and follow-up is a direct result of having to wait for an excavator to be available to assist in the follow-up remediation steps. Regarding Freshwater Wetland samples collected at F22 and F29, these two locations contained 6 to 7 feet of water and required bottom remediation. Remediation could only be done using an excavator capable of reaching the bottom of the excavation. Further delay occurred while waiting for a machine to be free. Given the volume of water contained within the open lead excavation area, a decision was made to allow for as much water as possible to evaporate prior to resuming additional excavation and sampling.
5. On the last page of Appendix E, Low Level Radiological Waste Manifests, a document, dated October 17, 2018, summarizes the lead concentrations for the following low-level radiological waste (LLRW) drum samples C8-U11 (13,000 mg/kg); and D12-U7 (140,000 mg/kg). The document states: "Per the APTIM Parcel E-2 Work Plan, Section 5.5.4 "A minimum of 1 foot in each direction of the surrounding soil will be removed and designated as LLRW. Therefore this soil was collected and designated as LLRW…Therefore, in accordance with BB&E guidelines, APTIM presented	The objects in question were detected and remediated from an RSY pad, specifically RSY pad C8 Use 11 and D12 Use 17. Figure 4 shows the layout of the RSY pad area. LLRO remediations are discussed in Appendix Z, RSY Pad Data Packages. In summary, the remediation referenced was not directly in response to lead contamination remediation. The minimum one-foot remediation, and the reference to the work plan text, is for LLRO remediation. The soil that

these materials to BB&E (HPNS) for radiological characterization and disposal." Describe the "2 [LLRO] remediations" in sufficient detail and show the areas on one or more maps. Provide acceptable documentation demonstrating the removal of a minimum of 1 foot in each direction of the surrounding soil, as well as the results of sampling and analysis demonstrating the attainment of hot spot goals. Provide an acceptable technical justification for over-excavating only 3 ft^3, given the level of lead contamination in this LLRW. Provide the waste characterization laboratory analytical reports; completed, approved disposal facility waste profile documents; and the manifests that account for the transportation and disposal of this lead-contaminated LLRW.	the letter in Appendix E is talking about is the soil that was removed as a result of LLRO remediation which was designated LLRW. Disposal of this lead-contaminated LLRW is presented in Appendix E.
6. As stated in Field Work Variance No. 5 (Appendix G), dated May 29, 2018, the Freshwater Wetland step-out, over-excavation "process has cleared all sample grid locations except for F08 and F25, which continue to demonstrate elevated concentrations for Lead (Figure 2)." At grid locations FW-SW-F25-SO-005 and FW-SW-F25-SO-006, lead was present in soil at concentrations of 33,000 mg/kg and 2,100 mg/kg along the south and west sidewalls (third over-excavation). It does not appear that sidewall over-excavation was extended to achieve the hot spot goal. Provide documentation that sidewall over-excavation was extended to achieve the hot spot goal along the south and west sidewalls at FW-SW-F25-SO-005 and FW-SW-F25-SO-006. If the lead-contaminated soil at those locations was not acceptable removed, then provide a plan to address residual lead in soil where present at concentrations above the hot spot goal.	The sidewall exceedances observed in FW-F25 were addressed in the lead investigation efforts. Specifically, the western sidewall was completely excavated with metal debris and located adjacent to FW-F08 and FW-F16. For better clarity, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland and Freshwater Wetland excavation, confirmation sampling to the main text.
7. Field Work Variance No. 5 (Appendix G) describes an effort to establish the extent of lead contamination west of sampling girds F08 and F16, by exploratory test pitting, sampling, and analysis for lead. Based on the laboratory analytical results, the bounded area shown on Figure 2 was proposed for over-excavation, to an approximate depth of 4 to 7 feet bgs. However, the Phase II RACR does not provide information sufficient to determine whether or not the lead-contaminated soil within the bounded area was removed and properly disposed. A. Describe whether or not the bounded area on Figure 2 was actually over-excavated. If it was, then provide acceptable documentation of the work	a. No soil exceeding lead criteria were left in the excavation of the lead contamination conducted under FWV #5. For better clarity, a new Figure 8 has been added to the RACR showing the excavations limits and the lead results of final confirmation samples. b. The referenced figure has been replaced with a new RACR figure, Figure 8, which shows the final bounded limits of the over-excavation for the final lead excavation. c. During the initial phases of chasing the lead contamination in the sidewall of FW-SW-F25, the concentrations were so high only

and the results of confirmation sampling and analyses demonstrating the attainment of hot spot goals. On Figure 2, the planned limits for over-excavation of lead-contaminated soil overlap sampling grids F08 and F16. However, the nomenclature used for the test pit samples includes "F25", which is also a grid location some distance away from the test pits (and addressed by Comment 6 above). B. Confirm that the locations of the test pits and planned over-excavation are as they appear on Figure 2. C. It is not clear why for some step-out, sidewall over-excavations three confirmation samples were collected (e.g., FW-SW-F25-SO-002, -003, and -004 on 2/15/18 for the 35,000 mg/kg south sidewall exceedance of 12/20/17), and for other excavations only one sample was collected (e.g., FW-SW-F25-SO-005 on 3/6/18 for the 48,000 mg/kg south sidewall exceedance on 2/15/18 and FW-SW-F25-SO-006 on 3/6/18 for the 46,000 mg/kg west sidewall exceedance on 2/15/18). Explain the rationale for collecting either one or three sidewall confirmation samples. Identify where in the Phase II RAWP the sampling frequency is described. D. In Appendix G, the table "HPNS Parcel E-2 Tidal and Freshwater Wetlands Confirmation Testing Results" includes lead results for FW-EB-PBOX- series and FW-SW-PBOX-series samples. Identify on a map these sample locations, and describe in the text what the results represent, as well as any follow-on action performed or still necessary to address lead contamination of up to 15,000 mg/kg (FW-SW-PBOX01-S003).	selected samples were analyzed to make decisions. The final lead excavation limits are shown in Figure 8 and show the final lead concentrations in the excavation sidewalls and bottom. The final bottom and sidewall confirmation samples are compliant with RAWP required frequency. Sampling frequency is described in greater detail within the Phase II RAWP under Section 7.2.1.2, "Step-Out Excavations" and the SAP, Appendix B, Worksheet #17, Section 17.1, "Excavation and Site Grading." d. New RACR figure 8 shows the location of the final samples for the lead. New RACR Table 6, shows the progression of lead results from initial to final.
8. Appendix X describes an investigation in the "Metal Slag and Ship Shielding Area." Six five-feet deep by four-feet wide excavations were completed to characterize the extent of lead contamination (Figure 4). Bottom samples were collected at 5 feet and sidewall samples at 2.5 feet (only the sidewall facing the Freshwater Wetland was sampled). Samples were analyzed for lead, and the results are summarized below.	No soil exceeding lead criteria were left in the excavation of the lead contamination conducted under FWV #5. For better clarity, a new figure (Figure 8) has been added to the RACR showing the excavations limits and the lead results of final confirmation samples. A new table, Table 8, has been added to summarize the progression of sample results.

Location	Bottom	Sidewall	Location	Bottom	Sidewall
FW-F16-ID-001	190,000	89,000	FW-F25-ID-001	5,300	75,000
FW-F16-ID-002	640	23,000	FW-F25-ID-002	14,000	190
FW-F16-ID-003	290	27,000	FW-F25-ID-003	61	1,200

Note: Results expressed in mg/kg. Results in red exceed the hot spot cleanup goal for lead.

Appendix X describes the following actions taken (presumably) to excavate the lead contamination in the Metal Slag and Ship Shielding Area.

- An Area around 100 feet by 100 feet was excavated
- Three sidewall locations required over-excavation
- One bottom sample required over-excavation (to 7 feet bgs).

The level of detail provided for this excavation work is inadequate. The Phase II RACR, among other things, should:

a. Clarify whether or not this excavation removed soil within the bounded area shown on Figure 4 (and Figure 2 of Appendix G).

b. Depict the 100-feet by 100-feet excavation on a map.

c. Describe the excavation depths.

d. Present the results of confirmation sampling and analyses that demonstrate removal of the full extent of lead contamination where present at concentrations above the hot spot goal.

e. If it cannot be demonstrated that the full extent of lead-contaminated soil was removed, then provide a plan to address unacceptable levels of residual lead in soil.

Response:

For better clarity, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland, and Freshwater Wetland and lead excavation, confirmation sampling to the main text.

Specifically, new figures 5 through 8 show the radiological screening and chemical sample locations summarizing the analytical strategy for the freshwater and tidal wetlands, while new tables 5 through 7 summarize the progression of the chemical confirmation testing results.

9. Appendix X states that "the [soil] waste [excavated from the Metal Slag and Ship Shielding Area] was characterized and stockpiled for off-site disposal. Resource Conservation and Recovery Act [RCRA] profiling is currently being done by U.S. Ecology under profile #070284198-0."

   a. Provide (or identify where in the Phase II RACR is located) all waste characterization laboratory analytical data and the completed, approved disposal facility waste profile documents.

   b. Given that this RCRA hazardous waste (soil) was stored on the site for an extended period, from about May 2018 to July 22, 2019, provide all Waste Inventory Logs and Waste Storage Area Inspection Checklists.

Response:

a. The final version of Appendix X has been revised to include an updated Table, Summary of Waste Materials from Parcel E-2, showing the final disposition of all off-site waste streams accompanied by a tabulated summary of the supporting waste sample results. Lab results for waste samples are included in Appendix AA, Analytical Data and Validation Reports.

b. Although the soil in question was classified as a RCRA hazardous waste, work within the HPNS Parcel E-2 site was conducted in accordance with CERCLA guidance, and the excavated soils were stockpiled within a contiguous area of contamination (AOC). Per EPA guidance, under AOC policy, consolidation is not considered to be removal, thus contaminated soil can be consolidated or

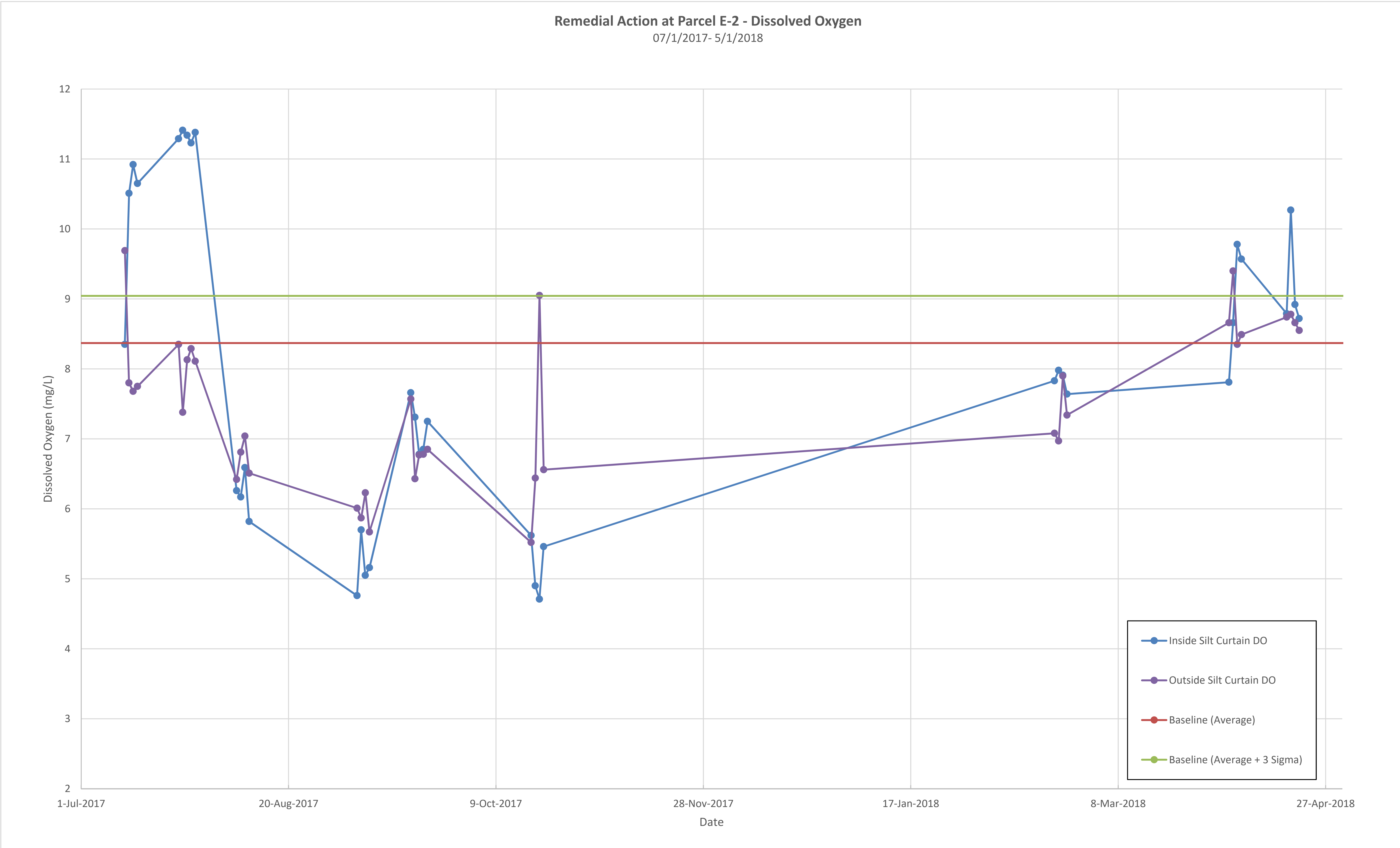
c. Include all Uniform Hazardous Waste Manifests (both Generator and TSDF-to-Generator copies), as well as any Land Disposal Restrictions documents.	managed within the AOC and a hazardous waste determination can be made after such consolidation. c. A summary of all required field documentation will be provided as part of the Final (Phase II) RACR submittal.
10. According to Appendix X, white crystalline lead oxide particles were observed, and samples were collected and analyzed. The maximum lead concentration was 190,000 mg/kg at location FW-EB-F16-ID-001. Appendix X states that "it would make sense that contamination was a direct result of the lead oxide that was previously used in the ship shielding area." Describe the relationship of the lead contamination discovered during 2018 exploratory test pitting in the "Metal Slag and Ship Shielding Area (App X, Fig. 4)," to the contamination in the Metal Slag Area and the Ship Shielding Area cleaned up from June 2005 to May 2006, and from May 2012 to October 2012, respectively, by time-critical removal actions (TCRAs).	The quoted statement was entered into the daily field paperwork as a statement of "opinion" by the on-site field chemist and was not intended as a statement of fact. For clarity, this statement will be stricken from the revised version of Appendix X. Any further investigation as to the relationship of the lead contamination discovered and past site activities should be considered outside the scope of APTIM's current contract.
11. In Appendix X, there are untitled tables with summary laboratory analytical results for various constituents for the following samples: PE2-SP-FW-COMP01, PE2-SP-FW-COMP02, PE2-SP-FW-COMP3, PE2SP-FW-DU1, PE2-SP-FW-DU2, PE2-SP-FW-DU3, and PE2-SP-FW-FD1. Identify on one or more maps the locations of the above-listed samples, describe in the text what the results represent, as well as any follow-on actions performed or still necessary to address the contamination indicated in the tables for those samples.	For better clarity, the RACR has been revised to move the discussion, tables and figures associated with the Tidal Wetland, and Freshwater Wetland and lead excavation, confirmation sampling to the main text.
12. In the Appendix X table, "Summary of Waste Materials from Parcel E-2" is indicated shipments of RCRA hazardous waste (soil) originating from the Freshwater Wetland Over-excavation and totaling 2,000 tons. On July 22, 2019, the RCRA hazardous waste (soil) was apparently transported to the US Ecology disposal facility in Beatty, Nevada. Based on the sampling dates provided in the Appendix X table, "HPNS Parcel E-2 Tidal and Freshwater Wetlands Confirmation Testing Results," waste soil containing elevated lead would have accumulated on site from about October 2017 to July 22, 2019. a. Include (or identify where in the Phase II RACR is located) all waste characterization laboratory analytical data and the completed, approved disposal facility waste profile documents.	a. The final version of Appendix X has been revised to include an updated Table, Summary of Waste Materials from Parcel E-2, showing the final disposition of all off-site waste streams accompanied by a tabulated summary of the supporting waste sample results. Lab results for waste samples are included in Appendix AA, Analytical Data and Validation Reports. b. Per EPA guidance, under AOC policy, consolidation is not considered to be removal, thus contaminated soil can be consolidated or managed within the AOC and a hazardous waste determination can be made after such consolidation. c. A summary of all required field documentation will be provided as part of the Final (Phase II) RACR submittal.

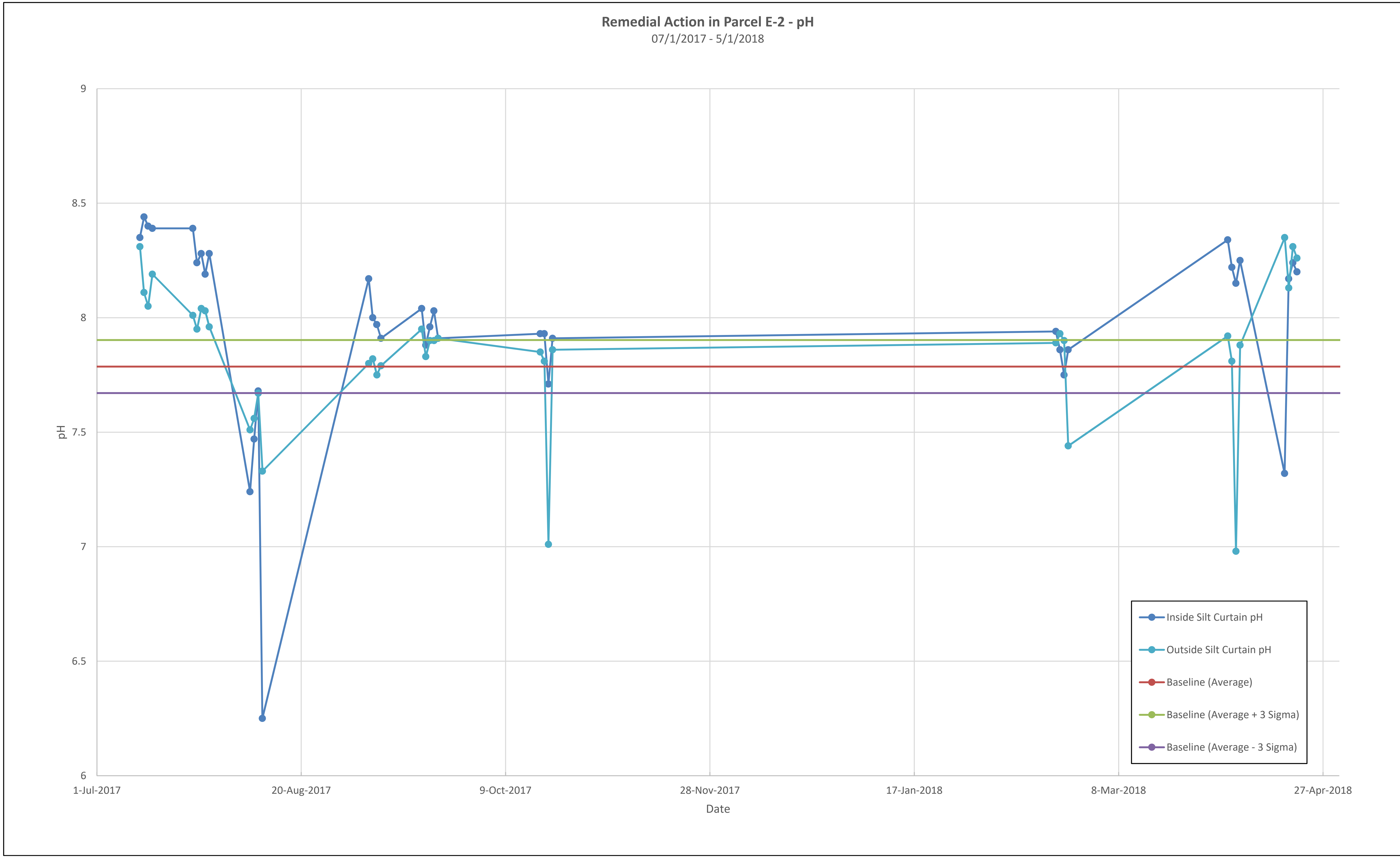
b. Given that this RCRA hazardous waste (soil) was stored on the site for an extended period, from about May 2018 to July 22, 2019, provide all Waste Inventory Logs and Waste Storage Area Inspection Checklists c. Include all Uniform Hazardous Waste Manifests (both Generator and TSDF-to-Generator copies), as well as any Land Disposal Restrictions documents	
13. Discharge of Lead to the Bay – As described above, we are concerned that residual contamination poses a threat to the health of the Freshwater Wetland and the Bay Given the proximity of lead oxide particles and lead-contaminated soil to the Freshwater Wetland, Freshwater Wetland Outfall, and the rock-lined swale that discharges to the Bay, evaluate the risks of exposure to terrestrial and aquatic wildlife. We recommend sampling and testing water of the Freshwater Wetland and the Freshwater Wetland Outfall, to evaluate the risks. Describe the results of the evaluation.	All of the lead contamination identified in the Freshwater Wetland grid F16 and F25 was removed for off-site disposal under FWV#05. New RACR Figure 8 shows the location of the final bounding samples for the lead. New RACR Table 5, shows the progression of lead results from initial to final. Additional investigation, including a complete fate and transport evaluation, should be considered outside the scope of APTIM's current contract.
14. Section 3.2, Remedial Action Objectives The control of groundwater via the Upland Slurry Wall and French drain, as well as by other remedies (Nearshore Slurry Wall and monitoring well network), will address the groundwater remedial action objectives (RAOs) for the protection of wildlife and are as follows: Prevent or minimize migration of chemicals of potential ecological concern to prevent discharge that would result in concentrations greater than the corresponding water quality criteria for aquatic wildlife. Prevent or minimize migration of A-aquifer groundwater containing total TPH concentrations greater than the remediation goal (where commingled with CERCLA substances) into SF Bay. Given that there is the 220-foot gap in the Upland Slurry Wall, described in detail how the performance of the Upland Slurry Wall will be monitored to ensure the achievement of the RAOs. Identify the monitoring well(s) between the Upland Slurry Wall and the Bay, to be used to monitor the performance of Upland Slurry Wall. Discuss whether or not the Remedial Action Monitoring Plan should be updated to account for the 220-foot gap in the Upland Slurry Wall through which A-Zone groundwater flows to the landfill, leaches landfill contamination, and travels to the Bay.	As designed, the upland slurry wall is considered a "hanging" slurry wall because it was not intended to key into an aquitard. As discussed within the final DBR, some groundwater will flow under the upland slurry wall, but groundwater modeling predictions (DBR Appendix F; ERRG. 2014) indicate that upgradient flow will mostly be diverted around the upland slurry wall or diverted to the freshwater wetland via the French drain (Section 3.2.14.7) installed on the upgradient side of the upland slurry wall. The nearshore slurry wall, which was installed by a previous contractor in 2016, serves to maximize the travel time of groundwater between areas upgradient of the barrier (i.e., the landfill) and the San Francisco Bay. The nearshore slurry wall will be supplemented by an upgradient well network to support monitoring and, if necessary, leachate extraction.

15. Section 3.2.14, Upland Slurry Wall Installation and Section 4.2, Upland Slurry Wall and French Drain The Phase II RACR concludes that the 220-foot gap in the Upland Slurry Wall results from "a distinct layer of serpentine weathered bedrock encountered approximately 10 feet bgs in the northwestern corner of the Parcel E-2 site." After completion of a subsurface investigation involving 12 borings and a review of "boring logs from historic documentation within the area," the Phase II RACR concludes that serpentine weathered bedrock was the "buried obstruction" that impeded upland slurry wall construction. a. Provide the boring logs and other relevant data from the 12-boring step-out investigation of the "buried obstruction," supporting the conclusion that serpentine weathered bedrock was the buried obstruction that impeded Upland Slurry Wall installation. b. Provide the boring logs from historic documentation within the area, supporting the conclusion that serpentine weathered bedrock was the buried obstruction that impeded Upland Slurry Wall installation.	a. Formal boring logs were not prepared as part of the direct-push drill rig investigation described under Section 4.2 of the RACR. The step-out investigation was only intended to confirm the presence/absence of the (as of that time, unknown) buried obstruction in relation to the proposed upland slurry wall alignment. As described under Section 4.2, no clear path around the subsurface obstruction was observed. b. Electronic copies of the relevant boring logs from the historic documentation within the area will be provide as part of the Final RACR submittal, as an attachment to this RTC file (Appendix A).
16. Last, please make every effort to address these comments in conspicuous, frontal parts of the report in text, tables, and figures, insofar as possible, rather than in the myriad pages of the appendices.	Comment noted.
17. Due to the 220-feet long by 10-feet deep obstruction, the USW was not constructed as designed. The USW as constructed acts as a gate through which groundwater is funneled to landfill waste, generating leachate that may pollute the San Francisco Bay. Further, a significant amount of groundwater likely will not be diverted to the FW for wildlife habitat. Consequently, it is uncertain whether the remedy will achieve the groundwater and surface water remedial action objectives (RAOs) for the protection of wildlife specified in the Record of Decision (ROD). We do not agree with the Navy's recommendation that "leaves the [USW] as constructed with no further alterations to the target depth," without acceptable evaluation of the effects of the gap. **We request the following, to understand the effects of the USW gap on remedy performance:** **a) The November 20, 2017, meeting minutes between the Navy Remedial Project Manager and Design Engineer (ERRG) discussing what was needed for the USW to meet the design objectives.**	a) Meeting minutes between the Navy and their third-party independent Quality Assurance inspector were not collected in preparation of the Parcel E-2 Phase II RACR. b) Work activity summaries and photographic documentation have been provided within the Final Phase II RACR as Appendix O and L respectively. Field logbook notes may be provided upon request; however, as previously discussed, neither boring logs nor analytical data was collected. As designed, the Upland slurry wall was not intended to key into an aquitard, nor was there a requirement to identify the top of a bay mud layer. During the Phase II Remedial Action, the Upland slurry wall was installed along the proposed alignment to the deepest depth practical. The supplemental step-out investigation was only intended to confirm the presence/absence of the (as of that time, unknown) buried obstruction in relation to the proposed upland slurry wall alignment. As previously discussed, no alternative alignment to

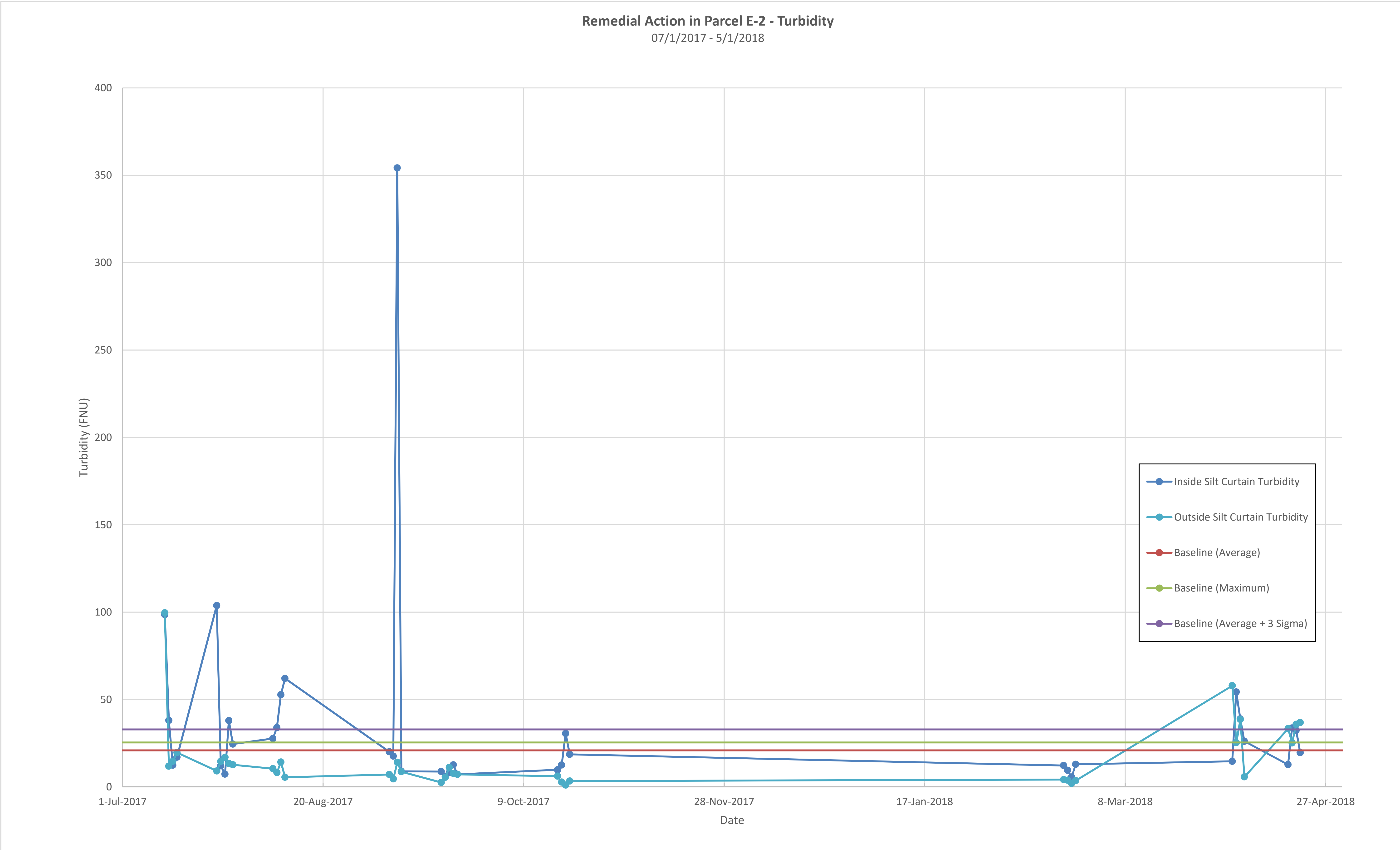
b) The records of the September 2018 investigation of the obstruction (e.g., report, logbook notes, boring logs, photographs, sample analytical data). **c) Data-driven evaluation of the USW/French drain system's ability to, in combination with other remedial actions, achieve the groundwater and surface water RAOs for the protection of wildlife.** **d) Develop and implement a follow-up action if the evaluation or other information demonstrates that the groundwater and surface water RAOs are not being achieved.** **e) A plan to evaluate the long-term performance of the USW and FW.**	the proposed slurry wall was identified, thus the wall remained along its current alignment. c) Further evaluation of the groundwater modeling predictions presented as part of the DBR (Appendix F; ERRG. 2014) is considered outside the scope of the Phase II contract. d) Evaluation of the long-term performance of the upland slurry wall and Freshwater wetlands will be monitored as part post-closure maintenance period and is outside the scope of the Phase II contract. e) A plan to evaluate the long-term performance of the USW and FW is outside the scope of the Phase II contract.
18. The full extent of "white crystalline lead oxide particles" and soil contaminated with lead above the hot spot cleanup goal was neither delineated nor removed during construction of the FW where it may intersect the Experimental Ship Shielding Range. Note, description of crystalline lead oxide particles encountered during FW excavation was removed from Appendix X; however, that information remains relevant. **Because the hot spot cleanup goal for lead was not attained, lead contamination poses risk to wildlife. The full magnitude and extent of crystalline lead oxide particles and soil contaminated with lead above the hot spot cleanup goal must be addressed.**	The full extent of the lead soil excavation to construct the future wetlands was documented under Section 3.2.10.1 of the Final RACR. Specifically, Figure 8 of the RACR shows extent of the final excavation footprint along with the bounding confirmation samples collected (Table 6) in accordance with the approved Sampling and Analysis Plan (CB&I, 2016). Once clean samples had been established (Figure 8), the excavation area was backfilled to achieve final subgrade elevations with on-site graded soil that had been radiologically screened and cleared for use as fill within Parcel E-2.
19. The RCRA hazardous waste soil pile was not managed in accordance with federal and State of California regulations, potentially resulting in releases of hazardous waste or hazardous waste constituents into the environment. **Investigation is needed to determine the nature and extent of any release of hazardous waste or hazardous waste constituents at the RCRA hazardous waste soil pile.**	The lead soil piles were excavated, staged, and stored with the intent of utilizing the provisions afforded via the CERCLA/RCRA directive known as the Area of Contamination Policy (AOC) - U.S. EPA, EPA530-F-98-026. The excavation area and the waste staging area were contiguous and as such were part of the entire AOC footprint at HPNS. Under the AOC policy, excavation of soil is not considered a "point of generation" and consolidation of excavated soils is not considered removal from the land. Therefore, the HPNS remediation soils were not subject to the 90-day RCRA storage requirements during the time they were consolidated and were maintained until offsite treatment and disposal was conducted.

	While staged within the AOC, the lead soil pile was managed on a raised RSY pad which was underlain by a continuous layer of HDPE plastic and approximately 1-foot of compacted soil, all of which was also characterized and removed for off-site disposal at the completion of the project. While staged, the soil pile itself was tarped with plastic sheeting and bermed with straw wattle wrapped in plastic to prevent infiltration from run-on. All soil stockpiles on site were regularly inspected as part of the required BMP inspections and any deficiencies were noted and repaired as soon as practical. This process was maintained until the remedial waste soils and debris were properly transported, treated, and disposed of at US Ecology located in Beatty, NE.


Remedial Action at Parcel E-2 - Dissolved Oxygen
07/1/2017- 5/1/2018
Dissolved Oxygen (mg/L)
12
11
10
9
8
7
6
5
4
3
2
1-Jul-2017
20-Aug-2017
9-Oct-2017
28-Nov-2017
17-Jan-2018
8-Mar-2018
27-Apr-2018
Date
Inside Silt Curtain DO
Outside Silt Curtain DO
Baseline (Average)
Baseline (Average + 3 Sigma)



Remedial Action in Parcel E-2 - pH
07/1/2017 - 5/1/2018
9
8.5
8
7.5
7
6.5
6
pH
1-Jul-2017
20-Aug-2017
9-Oct-2017
28-Nov-2017
17-Jan-2018
8-Mar-2018
27-Apr-2018
Date
Inside Silt Curtain pH
Outside Silt Curtain pH
Baseline (Average)
Baseline (Average + 3 Sigma)
Baseline (Average - 3 Sigma)



Remedial Action in Parcel E-2 - Turbidity
07/1/2017 - 5/1/2018
Turbidity (FNU)
400
350
300
250
200
150
100
50
0
1-Jul-2017
20-Aug-2017
9-Oct-2017
28-Nov-2017
17-Jan-2018
8-Mar-2018
27-Apr-2018
Date
Inside Silt Curtain Turbidity
Outside Silt Curtain Turbidity
Baseline (Average)
Baseline (Maximum)
Baseline (Average + 3 Sigma)